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Teaching guide

for Seeing through arithmetic 3

This is the Teaching Guide for *Seeing Through Arithmetic 3*, the third book of The Basic Mathematics Program, which is a unit of THE CURRICULUM FOUNDATION SERIES®, published by Scott, Foresman and Company.

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This book was designed by William Nicoll and illustrated by Janet LaSalle.

Teaching

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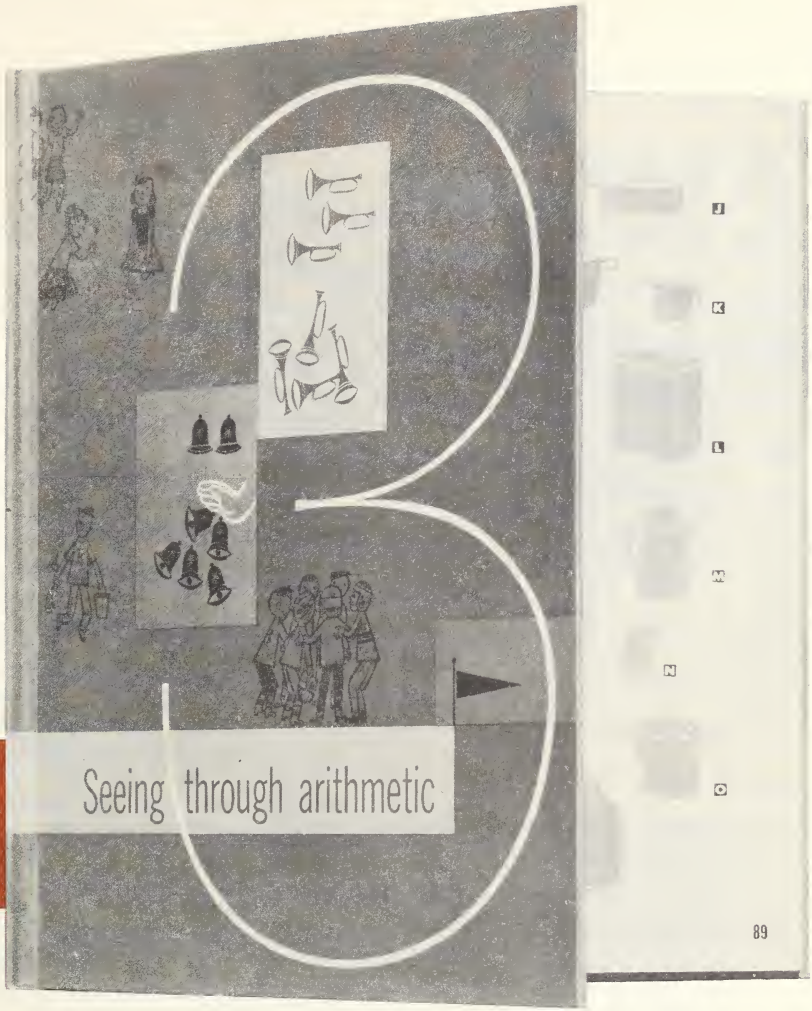

Scott, Foresman and Company

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Getting acquainted with this book

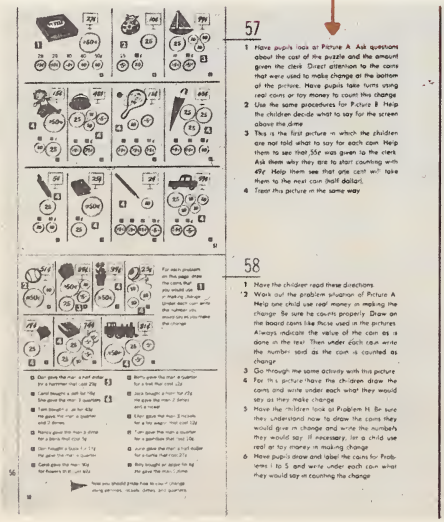
In this *Teaching Guide* you will find several different kinds of help in planning your work.

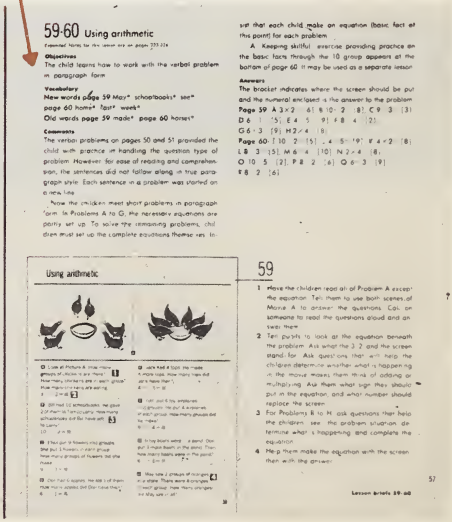
A section called

Lesson briefs

on pages 15-201

provides, through reduced reproductions of pupils' lesson pages and short, keyed teaching suggestions, a quick overview of how to teach the lesson pages in each block of work. Also outlined for you are objectives, new vocabulary, brief comments on the block of work in general, and an answer key for exercises (except those concerned with the basic facts) and problems.





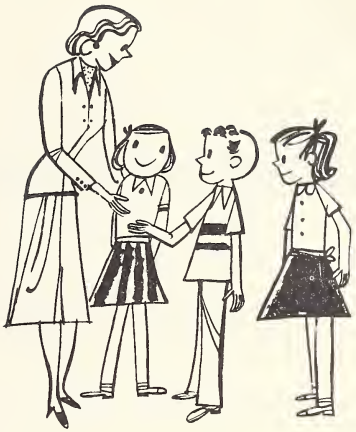
A section called

Expanded notes

on pages 203-310

gives detailed suggestions for teaching each lesson. The Expanded Notes for each block of work are organized to provide for individual differences. First there are teaching suggestions for the class as a whole, then special suggestions for able pupils, and finally, suggestions for the slow learners. Sections called "Charting the Course" are interspersed throughout the Expanded Notes to introduce a block of work or related blocks of work. They describe how the major blocks of work in the pupils' book fit into the total arithmetic program. They may be read all at one time, or individually as the work with the book progresses. You should, however, have these general principles in mind as you examine the more detailed suggestions that are provided for teaching each lesson.

On pages 311 to 333 you will find carefully selected activities and games to enrich the class work. On pages 335 to 352 you will find such helps as a list of professional books and articles, a chart of problem types, a grade placement chart, a time schedule, and a list of vocabulary.



The various kinds of helps are so organized as to meet the needs of teachers. For some, the brief notes keyed to the reproduced pages from the pupils' book may be sufficient. Others may want to use the Expanded Notes and activity suggestions. You can decide for yourself how much use to make of these varied materials in the *Teaching Guide*.

You will find it profitable to read the brief overview of the major features of the *Seeing Through Arithmetic* program described in the section

Guiding principles

that follows.

Explained there are the features of this program, all of which have been designed to help you and your pupils discover that learning arithmetic can be an interesting and satisfying experience.

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Guiding principles

The objective: insight

Arithmetic is a fundamental subject.
Children should learn to use it with ease,
with confidence,
and with enjoyment.

The best way to reach this goal is to help children gain insight into arithmetic.

"Insight" is a term that has come into prominence in modern psychology. Insight depends upon the recognition of relationships. When insight occurs, the parts that make up a total situation are seen in relation to each other and to the whole situation. The number system, for example, involves many relationships. When children have gained insight into these relationships, a great many facts that would otherwise remain isolated are recognized as elements of a few general principles. Then the processes of arithmetic become understandable, and not just a set of arbitrary rules.

Seeing Through Arithmetic 3 provides for the development of insight in three major ways:

1 The learning of arithmetic is simplified by the way the work is organized.

2 Problem solving is clarified by use of principles and techniques that help pupils learn to analyze problem situations.

3 New and improved methods of presentation are systematically used to make the learning of arithmetic easier and more enjoyable than it has been in the past.

These features and the psychological backgrounds for them are explained in the following sections.

1 Simplified organization

Organization of the learning situation is of great importance in fostering insight. When the aim is recognition of relationships, the work must be organized to achieve this purpose. The effect is then cumulative: better understanding at each stage contributes to better understanding at following stages. The result is that fewer treatments of a topic are needed, and the organization of the subject as a whole is simplified.

For several decades the trend in arithmetic was toward increasing complexity in the organization of topics. This came about because the stimulus-response theory dominated instruction in arithmetic. Every desired response was specifically identified and connected to a stimulus for it. With this psychology as a basis, drill played a dominant rôle.

The process of addition, for example, was usually separated into many—a dozen or more—different

"skills." Addition of two-figure numbers *with* carrying was delayed for weeks or even months after addition *without* carrying had been taught.

Because of these traditional organizations, children often failed to understand the nature of the task as a whole. For example, when addition without carrying comes first, the pupil cannot understand why he is told to begin adding with the "ones." He can find the right answers by working with the "tens" first. He can work the examples either way he pleases and often forms bad habits that escape notice by the busy teacher. In the long run, lack of insight on the part of the pupil makes the situation more difficult for both pupil and teacher.

In *Seeing Through Arithmetic 3,* addition of two-figure numbers is introduced with an example that involves carrying.* When the child understands the way groups of ones must be reorganized to make tens—the chief idea in addition of two-figure numbers, he has the main idea. He sees the "whole" situation. Learning to add by working many examples without any carrying before meeting one that does require carrying develops a false concept of addition. It is like learning to drive on a street where, by special arrangement, the traffic control lights are *all* green and cease to be observed by the driver. In accordance with the same general principle, the process of subtraction is introduced by examples that require borrowing.* These examples are immediately followed by one that does not require borrowing.

The principle of introducing a process by using examples that are as representative as possible of the process as a whole is followed throughout *Seeing Through Arithmetic 3.* The central learning difficulty is faced at the outset and is not evaded. When the pupil understands how to deal with really *representative* examples, he can use his understanding to dispose more easily of the special cases that arise. In brief, learning tasks are so organized as to develop *insight* and to enable the pupil to use it as a means to further learning.

Several other organizational features of *Seeing Through Arithmetic 3* are noteworthy. For example, no processing of number symbols by addition is introduced until *all* the basic facts of addition have been taught. As a result, when column addition and similar processes are introduced, no special attention

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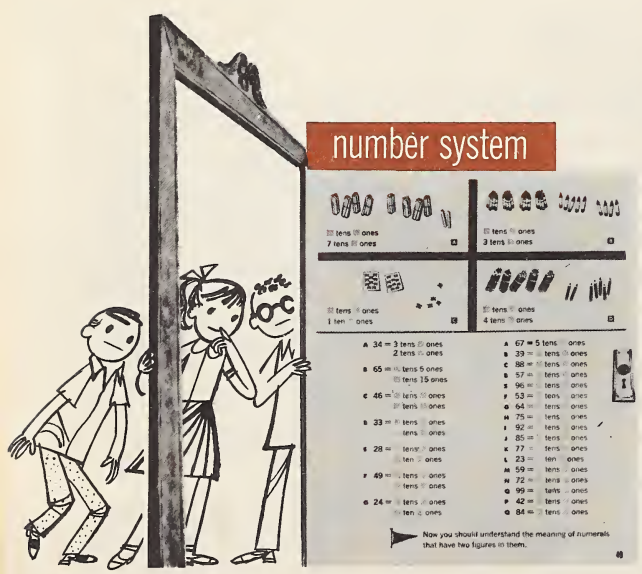
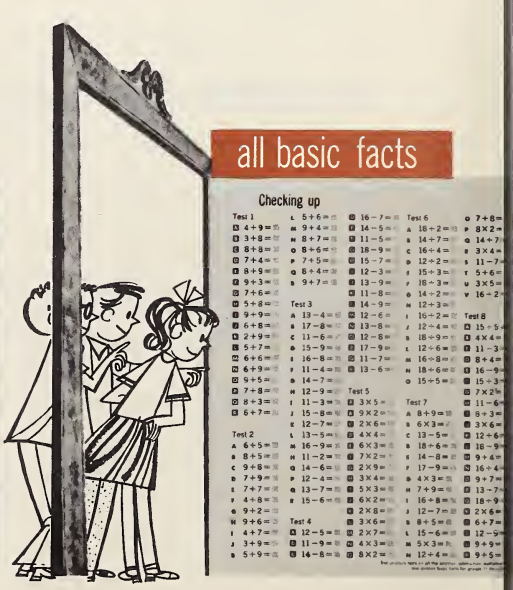
* *Seeing Through Arithmetic 3,* pages 160-163.

* Some teachers object to the terms "carrying" in addition and "borrowing" in subtraction. The authors of this book emphasize the importance of understanding the process and discount the importance of a name or any purely verbal distinction.





needs to be given to the selection of the number facts involved. This is in contrast to organizations of arithmetic that introduce column addition, adding two-figure numerals without carrying, and so on, before all the basic facts are known by the pupil. In such organizations of material, great care must be taken by textbook authors and the teacher to avoid presenting examples whose processing requires factual knowledge the children have not yet acquired. These purely artificial difficulties are avoided in *Seeing Through Arithmetic 3.*

The principle of introducing all the basic facts before processes are attempted is followed for both addition and subtraction. The multiplication and division basic facts through 36 are introduced in *Seeing Through Arithmetic 3,* but the computational processes are deferred to a time when *all* the facts have been taught. Consequently, these processes are not presented until *Seeing Through Arithmetic 4.*

These are only a few of the many examples of reorganization suggested by psychological principles concerned with the development of insight. The simplification in organization discussed above is feasible in this program because new visual methods of presentation and provision of a good understanding of the number system are used to open the door to insight.

2 Problem solving

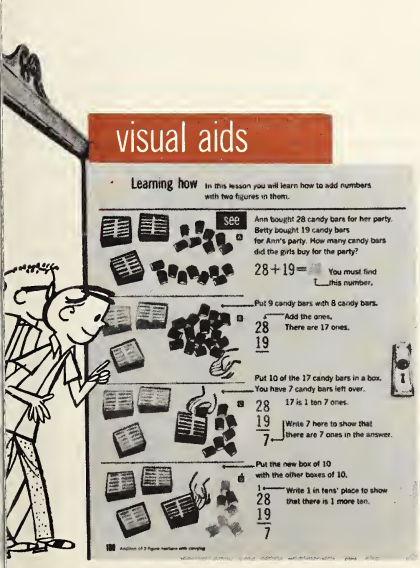
In *Seeing Through Arithmetic 3,* insight into problem solving is fostered by the systematic use of distinctive methods of teaching. First, the pupil is helped to recognize what is happening in the problem situation. Second, he is taught to describe the situation by using arithmetic symbols. This symbolizing includes the use of very simple equations. Third, the pupil is shown how to select the proper arithmetic process to solve the equation.

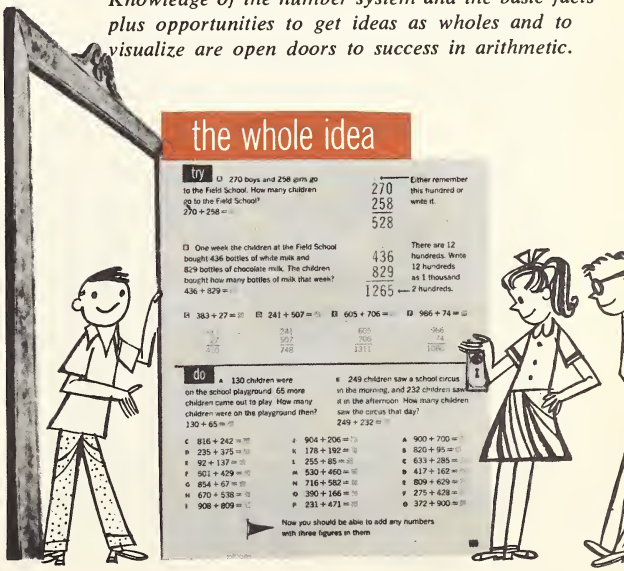
Analyzing the problem situation

In the past, little has been done to help pupils develop skill in analyzing problem situations. The instructional methods have relied heavily upon "cue" words. (Examples: How many *in all?* How many are *left?)* They also have relied on advice which is of no real help to the pupil. (Examples: Read the problem carefully. Think what to do with the numbers.) The difficulty of many problems lay in the pupil's inability to analyze them.

To understand the nature of a problem, the pupil must be able to recognize the type of action that takes place. For example, when one group joins another group, the action is called *additive.* In other situations

Knowledge of the number system and the basic facts plus opportunities to get ideas as wholes and to visualize are open doors to success in arithmetic.


visual aids
Learning how
In this lesson you will learn how to add numbers with two figures in them.
see
Ann bought 28 candy bars for her party. Betty bought 19 candy bars for Ann's party. How many candy bars did the girls buy for the party?
28 + 19 =
You must find this number.
Put 9 candy bars with 8 candy bars.
Add the ones. There are 17 ones.
28
19
Put 10 of the 17 candy bars in a box. You have 7 candy bars left over.
17 is 1 ten 7 ones.
28
19
7
Write 7 here to show that there are 7 ones in the answer.
Put the new box of 10 with the other boxes of 10.
1
28
19
7
Write 1 in tens' place to show that there is 1 more ten.


the whole idea
try
270 boys and 258 girls go to the Field School. How many children go to the Field School?
270 + 258 =
Either remember this hundred or write it.
270
258
528
One week the children at the Field School bought 436 bottles of white milk and 829 bottles of chocolate milk. The children bought how many bottles of milk that week?
436 + 829 =
436
829
1265
There are 12 hundreds. Write 12 hundreds as 1 thousand 2 hundreds.
383 + 27 =
241 + 507 =
605 + 706 =
986 + 74 =
do
130 children were on the school playground. 65 more children came out to play. How many children were on the playground then?
130 + 65 =
249 children saw a school circus in the morning, and 232 children saw it in the afternoon. How many children saw the circus that day?
249 + 232 =
A 816 + 242 =
B 235 + 375 =
C 92 + 137 =
F 501 + 429 =
G 854 + 67 =
H 670 + 538 =
I 908 + 809 =
J 904 + 206 =
K 178 + 192 =
L 255 + 85 =
M 530 + 460 =
N 716 + 582 =
O 390 + 166 =
P 231 + 471 =
A 900 + 700 =
B 820 + 95 =
C 633 + 285 =
D 417 + 162 =
E 809 + 629 =
F 275 + 428 =
G 372 + 900 =
Now you should be able to add any numbers with three figures in them

a single group is seen at first, but if part of this group is taken away, a *subtractive* action occurs. Sometimes the objects themselves do not actually move, and it is necessary to imagine that combining or separating action occurs. In still other situations, actions occur that are called *multiplicative* or *divisive*. Such actions, real or imagined, are always important aspects of the total situation. The child learning arithmetic with insight should learn to recognize each of these four kinds of action.

The teaching of problem solving in *Seeing Through Arithmetic 3* is based on clear distinctions among: (1) the recognition of the situations with their actions, (2) the use of symbols to show what is happening, and (3) the processing of the symbols; i.e., adding, subtracting, multiplying, and dividing. These distinctions are important because the process used is not always what the action of the situation seems to suggest. For example, there are problems in which the child is usually taught to subtract, but which, as he sees them, are additive situations. Thus, consider the following situation: "John has 25 cents, and he wants to buy a toy truck that costs 45 cents. How much more money does he need?" There is evidence in the research on arithmetic that children tend to think of this as an additive problem.* This tendency is not at all surprising. Some money must be combined with the 25 cents to make the needed 45 cents. All the child's previous experiences have taught him to think of the combining of two groups as an additive situation. Too often this difficulty is not recognized, and the child is told only that this is a subtraction problem. Confusion and lack of understanding naturally result.

In *Seeing Through Arithmetic 3,* the child is not only permitted to think of the above situation as additive—he is *taught* to think this way. Although the situation is admitted to be additive, he learns that the answer is obtained by the process of subtraction. He is given help in analyzing the situation and gains insight concerning the nature of the solution. In short, he learns how to see it and how to think about it (see pages 75 to 78 of the pupils' textbook).

* See, for example, Gibb, E. Glenadine, "Children's Thinking in the Process of Subtraction." Unpublished doctoral dissertation, University of Wisconsin, Madison, Wisconsin; and Lazerte, M. E., *The Development of Problem Solving Ability in Arithmetic.* Clarke Irwin and Co., Ltd., Toronto, 1933.

Another example will help clarify the distinction. The problem reads: "Mary spent 35 cents during a shopping trip. When she got home, she found she had 47 cents left in her purse. How much money did Mary have in her purse before she started her shopping?" The child who understands this problem situation sees that spending 35 cents is a subtractive action. Previous experience has taught him this. However, to get the answer, he must add 35 and 47. This is a situation in which the action suggests subtraction, but the process of addition must be used to get the answer. Obviously, careful teaching is called for if the child is not to be confused.*

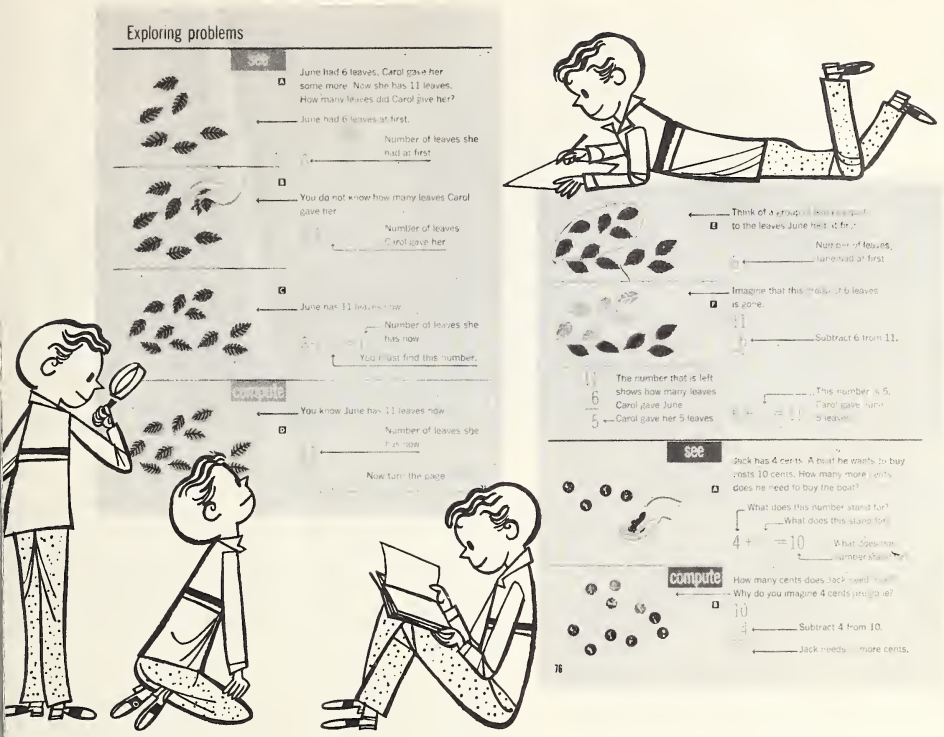
Teachers often say the difficulty in problem solving is that "the pupils cannot read the problems." The pupils usually recognize the individual words; what the teacher means is that the pupils cannot *interpret* the *situations*. Dependence on "cue" words or other superficial techniques leaves the pupils in a weak and helpless position. They must learn to base their decisions about which process to use on an understanding of the total situation. The development of such an understanding on the part of the child has been of primary concern to the authors of this text.

The basic types of problems introduced in each grade are selected from a complete list of such types. A table of these types appears on pages 340-341 of the *Teaching Guide*. This list, which is the result of an analysis by the authors, provides a guide for a consistent and comprehensive treatment of problem solving. Only the eight simplest types of problems are presented in *Seeing Through Arithmetic 3*. The reader should not infer from this organization for teaching purposes that the pupil is expected to recognize each problem by its type and follow a routine procedure for that type. Some problems can be correctly viewed in more than one way. What is essential is that the pupil who adopts a possible view knows what to do with the situation as he sees it.

Describing the situation by using symbols

As a second major aspect of problem solving, the child learns how words and other symbols are used to say or

* This type of situation is introduced in *Seeing Through Arithmetic 4*, pages 134-137. For a more extended discussion, see the Lesson Briefs for these pages in the *Teaching Guide* for Book 4. This situation is an example of a general type which is called "subtractive-addition" by the authors.

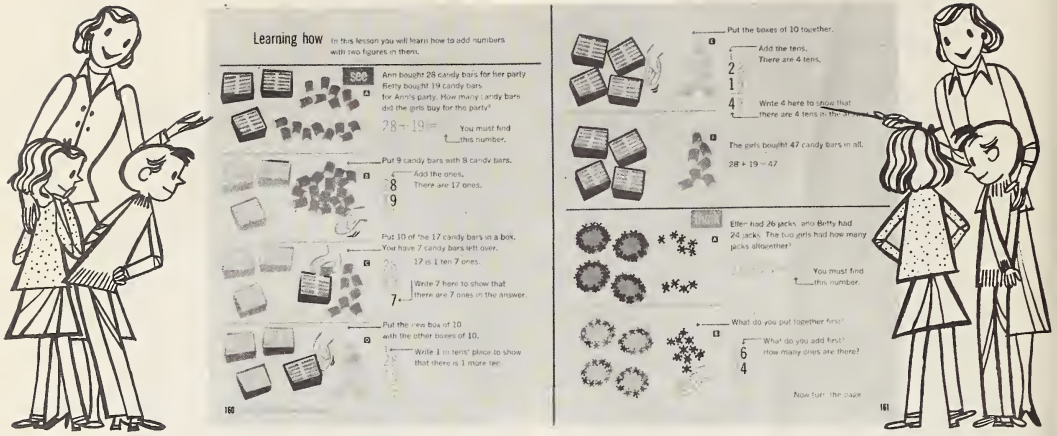

Exploring problems
see
June had 6 leaves. Carol gave her some more. Now she has 11 leaves. How many leaves did Carol give her?
June had 6 leaves at first.
Number of leaves she had at first
You do not know how many leaves Carol gave her.
Number of leaves Carol gave her
June has 11 leaves now.
Number of leaves she has now
You must find this number.
compute
You know June has 11 leaves now.
Number of leaves she has now
Now turn the page.
Think of a group of leaves equal to the leaves June had at first.
Number of leaves June had at first
Imagine that this group of 6 leaves is gone.
Subtract 6 from 11.
The number that is left shows how many leaves Carol gave June.
Carol gave her 5 leaves
This number is 5. Carol gave June 5 leaves.
see
Jack has 4 cents. A boat he wants to buy costs 10 cents. How many more cents does he need to buy the boat?
What does this number stand for?
What does this stand for?
What does this number stand for?
compute
How many cents does Jack need more?
Why do you imagine 4 cents should be?
Subtract 4 from 10.
Jack needs more cents.
76

write what happens. In particular, he uses number symbols (15, 31, 5, etc.) to tell how many are in a group of objects. Other symbols (+, −, ×, ÷) are used to express the actions. Thus the equation 27+46=▒ shows that a group of 46 objects is joining a group of 27 objects and that the number of the combined group is wanted. In every case the oral or written expressions derive their meaning from the situations out of which they are seen to arise.

In *Seeing Through Arithmetic 3,* lessons entitled "Exploring problems" show the pupil how to write simple equations to describe the problem situations. This part of the lesson is labeled "See." The lessons lead him to *analyze the situation* instead of rushing on to a computational process that may or may not be appropriate. The equation focuses attention on understanding the situation and serves as a record of how the pupil sees and thinks about the situation. If the pupil cannot analyze the situation, any attempt to do the computational step is a futile procedure.

Processing the arithmetic symbols

As the third major aspect of problem solving, the child learns to go through the appropriate process with the number symbols. In the simplest situations this involves the direct use of the addition, subtraction, multiplication, or division process as indicated by the equation. In other situations, as was noted above, the process is not the same as the action in the situation suggests. In these cases the pupil must be helped to see why another process can be used. In *Seeing Through Arithmetic 3,* he is shown how to think about the situation in a way that reveals the appropriate process. He is then ready to compute with insight into the total situation. This part of the problem-solving lesson is labeled "Compute."


Learning how
See
Ann bought 28 candy bars for her party
Betty bought 19 candy bars
for Ann's party. How many candy bars
did the girls buy for this party?
28 + 19 =
You must find
this number.
Put 9 candy bars with 8 candy bars.
Add the ones.
There are 17 ones.
8
9
Put 10 of the 17 candy bars in a box.
You have 7 candy bars left over.
17 is 1 ten 7 ones.
Write 7 here to show that
there are 7 ones in the answer.
7
Put the new box of 10
with the other boxes of 10.
Write 1 in tens' place to show
that there is 1 more ten.
160
Put the boxes of 10 together.
Add the tens.
There are 4 tens.
2
1
4
Write 4 here to show that
there are 4 tens in the answer.
The girls bought 47 candy bars in all.
28 + 19 = 47
See
Ellen had 26 jacks, and Betty had
24 jacks. The two girls had how many
jacks altogether?
You must find
this number.
What do you put together first?
What do you add first?
How many ones are there?
6
4
Now turn the page.
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3 Effective methods

In *Seeing Through Arithmetic 3,* the learning of arithmetic is made efficient and enjoyable for most children by a variety of new methods of presentation. These methods include extensive creative use of the pictorial and typographic arts and many other features of presentation, emphasis, and organization. Introduction of these features is based on accepted principles of learning theory. These methods are used systematically, not erratically or superficially. A complete discussion of all of these methods would unduly extend these introductory comments, but some general remarks are included here.

The number system

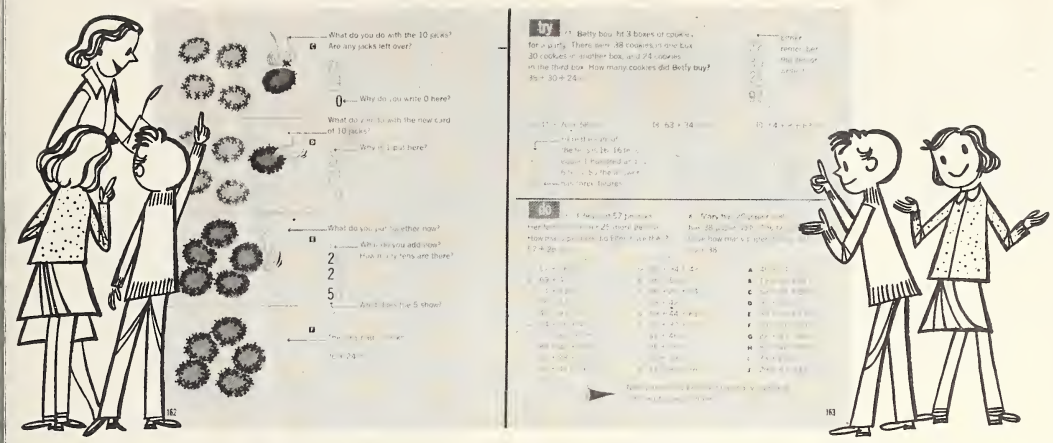
Seeing Through Arithmetic 3 provides an unusually careful development of the number system. Many pictures showing the grouping and regrouping of objects in tens, in hundreds, and so on, are accompanied by corresponding arrangements of numerals in terms of place-value ideas. (See, for example, pages 42 to 45 of the pupils' textbook.) Seeing numbers as members of a system involves seeing *relations,* and thus requires much more than knowing the names of the "places" in written numerals. There is much talk nowadays about teaching the number system. *Seeing Through Arithmetic 3* teaches it thoroughly and distinctively. In particular, the lessons provide experiences that cultivate readiness for carrying and borrowing.

The basic facts

The basic facts the child needs to know to solve arithmetic problems are introduced pictorially. Care is taken to insure the child's understanding of them and also of the various terms and symbols commonly used in connection with them. No preferred way of stating or writing them (for example, 2 threes = 6 instead of 2 times 3 = 6) is given. Instead, all of the forms in common use are introduced and used because children must be prepared to understand them wherever or however they occur outside the classroom. This is consistent with the authors' conviction that in producing understanding, verbalizations are far less effective than pictures, active work with objects, and similar concrete experiences.

Presentation of processes

The "four-step teaching method" is another feature of *Seeing Through Arithmetic 3.* This method is used in sections called "Learning how" in which the processes are taught. (See, for example, pages 176-179.) In Step 1, called "See," the pupil is shown in detail what to do. Pictorial representations show what happens to the objects involved. The process with the symbols is shown and is closely connected with the visual representation. Verbal explanations are included, but they are simple and brief. In Step 2, called "Think," another example is worked out and the pupil is asked some questions about important details. He is encouraged and helped to *think* about the example. In



Step 3, called "Try," other completely worked out examples are given, but the pupil is expected to work these out for himself and then compare his work with the completed examples in his book. In Step 4, called "Do," examples for practice are given. Steps 3 and 4 are designed for independent work by the pupils.

The "four-step method" has proved its effectiveness through years of use. In *Seeing Through Arithmetic 3* it has been adapted to new visual techniques and modern principles of learning theory. It guides the pupil so that, literally, he can see, think, try, and really do a process on his own and with confidence.

Visual aids

In *Seeing Through Arithmetic 3*, all pictures are learning aids. No picture is presented for its purely decorative or presumed interest-generating value. In many cases the pictures show both the basic data and the action—that is, the grouping and regrouping involved in the problem situation. The child can actually see what is happening. Moreover, because many lessons employ a sequence of related scenes, or "movies," they serve as a guide to teachers and pupils who wish to use actual objects to gain additional experience with the ideas. The Expanded Notes contain many suggestions for this kind of enrichment.

In similar fashion, the use of colors and of many special printing devices is the result of careful study. Color is used not only to add general attractiveness or to call attention to some special point, but also to help teacher and pupils communicate with each other. For instance, the teacher may say, "Now we will do the examples beside the red letters." A special printing device is used to "dim off" parts of pictures that are not to be in the focus of attention. The design of every page is worked out with teaching values as a dominant criterion. The goal is to help the child see—visually and intellectually—what he is asked to learn.

Vocabulary control

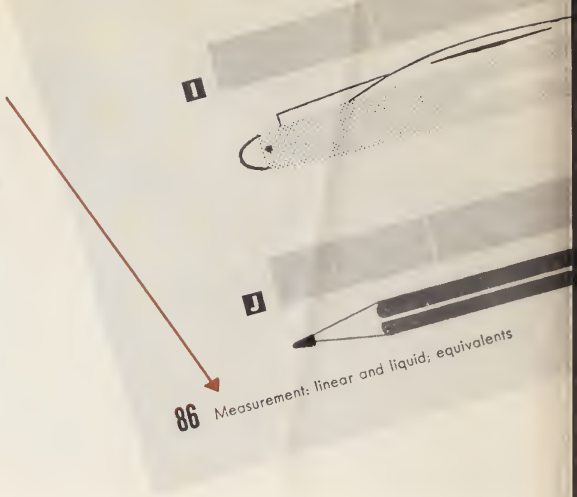
The purpose of studying arithmetic is to learn how to solve quantitative problems. A vocabulary and general reading abilities are of course necessary. However, since the task of learning arithmetic is sufficiently difficult for the child, it is foolish to add extra burdens in the form of vocabulary and reading difficulties. For this reason the vocabulary of *Seeing Through Arithmetic 3* is carefully controlled.

In *Seeing Through Arithmetic 3* it is assumed that the children know only the 158 reading words (both arithmetical and general) that appeared in the second-grade number book, *Numbers in Action*. Of these 158 words, 147 are used in *Seeing Through Arithmetic 3*. These words are listed as they appear, for the convenience of the teacher, at the beginning of the Lesson Briefs for each block of work. All other words are considered new words and are also listed, for special attention by the teacher, for each block of work. New words are introduced at a cautious rate. The total vocabulary of *Seeing Through Arithmetic 3* is 436 words. See pages 344-345 of the *Teaching Guide* for a complete alphabetical list of the words used.

Lesson headings

Seeing Through Arithmetic 3 uses headings that describe the nature of the various types of lessons. They serve to alert the child immediately as to whether he will be learning a new computational skill, practicing problem solving, maintaining skills, etc. In connection with these headings, there is, whenever necessary, a statement to the teacher (in small type opposite the page number) that gives a technical description of the content of the lesson. With some of these lessons, too, there is a statement giving the child more information about the nature of the lesson.

All material in *Seeing Through Arithmetic 3* is organized under nine headings:



Learning how	development (or review) of understandings and skills through the four-step teaching method
Exploring problems	development of specific problem-solving techniques
Moving forward	new concepts and skills not otherwise included in "Learning how" or "Exploring problems"
Using arithmetic	verbal problem situations for practice
Keeping skillful	mixed practice for systematic maintenance of concepts and skills
Checking up	examples which may be used either to inventory what has been learned or as tests of achievement
Thinking straight	"short cuts" and problems involving a variety of special difficulties or methods. These sections are primarily for above-average pupils.
Looking back	review material, except that which is retaught by means of the four-step teaching method under the heading "Learning how"
Side trip	enrichment materials on various topics relating to the arithmetic program

These various types of lessons provide a wealth of material for the teaching of concepts, for practice, for maintenance, for review, and for testing achievement. Teachers who want suggestions on the uses of these materials will find them in the Lesson Briefs (pages 15-201) and in the Expanded Notes (pages 203-310) for each section and page. In toto, these materials provide the basis for effective lesson planning by teachers and effective learning by pupils.

Lesson briefs

This section of the *Teaching Guide* contains the aids that every teacher will need in using *Seeing through Arithmetic 3*. Collected together in one place for your convenience you will find:

Objectives

A very brief statement of the purpose of the lesson to help you see its relation to the program

Vocabulary

Two lists for each lesson: words new to the program and words reused from the preceding book

Comments

Helpful information about the arithmetic itself and about methods of teaching

Answers

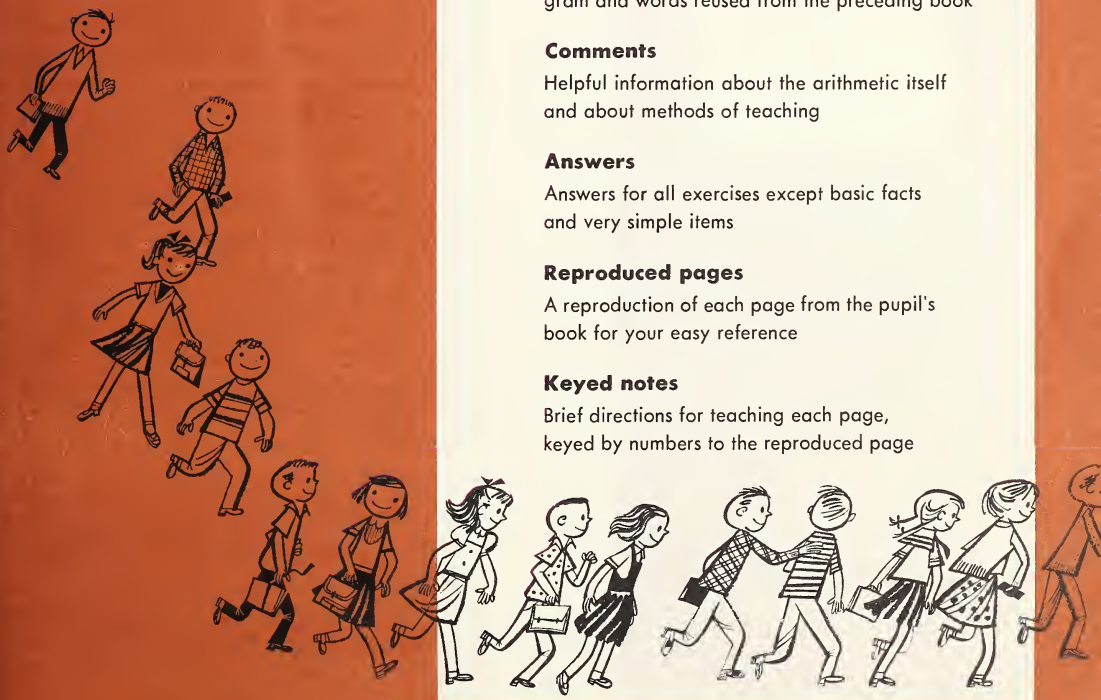
Answers for all exercises except basic facts and very simple items

Reproduced pages

A reproduction of each page from the pupil's book for your easy reference

Keyed notes

Brief directions for teaching each page, keyed by numbers to the reproduced page



Lesson briefs

A productive teaching situation includes interested children, an inspired teacher, and good materials. In using the materials of this program, do not forget the Expanded Notes on Pages 203 to 310.

3-6 Moving forward

Expanded Notes for this lesson are on pages 204-210.

Objectives

The child learns to recognize situations in which one group of objects is combined with another group of objects to make a larger group. He becomes acquainted with the addition basic facts for the 2, 3, 5, and 7 groups (basic facts whose sums are 2, 3, 5, and 7).

Vocabulary

The vocabulary list for each block of work is divided into two parts. The first part (New words) is a list of words that are new to this arithmetic program. Words already familiar to children who have completed The New Basic Reading Program through *More Friends and Neighbors* (2/2) are marked with asterisks. The second part (Old words) lists words that appeared in the second-grade book of this series, *Numbers in Action.* Here again asterisks mark the words introduced in The New Basic Reading Program through 2/2.

New words **page 3** pages, learn*, about*, make*, that*; **page 4** coming*; **page 5** carrying*, help*; **page 6** jacks*, should*, know*

Old words **page 3** on*, to*, you*, will*, the*, groups, numbers, and*; **page 4** boys*, are*, playing*, then*, plus, equal, is*, how*, many*, girls*, be*; **page 5** ball*, box*, there*, add; **page 6** now*

You will want to be sure to use the arithmetic words *plus, equal, equals,* and *add* orally before the children meet them in their reading. Use *plus* and *equal* with page 3. Use *add* before page 5. On page 6, begin to use the word *equation* in referring to the horizontal form of stating the basic facts, but do not require the children to use it at this time.

Comments

If you have not already read the introduction to this *Teaching Guide,* you will want to do so before proceeding further with these comments and the Lesson Briefs. To use the *Teaching Guide* effectively, you should be familiar with the general aims and principles underlying this program. See pages 6-14.

Children will be better prepared to learn the basic facts if they can recognize groups up to ten objects without counting. Suggestions for developing this ability appear in the Expanded Notes for this lesson. Specific reference to the Expanded Notes is made at the beginning of the Lesson Briefs.

On page 3, children see what happens when one group is combined with another group. We call this an additive situation. Children first work with picture strips or "movies" that show one group of objects joining another group of objects and the larger group that results when the joining action is completed. Then they see additive situations in which the action of one group joining another group is shown taking place but not completed. Children must complete the action mentally and determine the size of the group that results. The basic facts for $3+4$,. $1+4$, $4+3$, $4+1$, $2+1$, $1+1$, $2+3$, and $1+2$ are illustrated.

On page 4, children learn to read statements such as "5 plus 2 equals 7" and "$3+2=5$," and to know that they are ways of describing what happens when one group joins another. By working with pictures accompanying the text, children learn that the symbols in the text are used to describe the actions shown.

In this book the screen (▤) is a device used to indicate that a number is to be supplied by the child. Statements about specific additive situations are followed by statements of basic facts. The aim is to help the child see that a basic fact such as $5+2=7$ describes what happens when a group of five boys is joined by a group of two boys, although the word *boys* is omitted. He learns to understand that $5+2=7$ can be used to describe all other situations in which a group of five is joined by a group of two, regardless of what objects make up the groups. The basic facts for $5+2$, $6+1$, $3+2$, and $2+5$ are presented here.

Page 5 introduces the word *add* in such expressions as "add 2 to 5." When pictures are used showing the action of joining, for example, a group of 2 to a group of 5, you will find that "add 2 *to* 5" is more meaningful for children than "add 2 *and* 5." The new basic fact presented on this page is $1+6=7$.

Up to page 6 the basic facts have been written only in the horizontal or equation form ($2+3=5$), which is really a sentence. This enables the children to read a basic fact as they would read any sentence, from left to right. In the equation there is a symbol for each word the child would say or think in reading it. This form also prepares them for the important use of the equation in problem solving.

On page 6 the vertical form of addition is presented. This will be referred to as the computational form hereafter. Note that the *plus sign* is not used at the left of this form. In this book the signs are used only in the equations. When arithmetic is used to solve problems, whether in school or out, the process to be used ($+$, $-$, $\times$, $\div$) is always known before the numbers are written in computational form; therefore, the signs are not needed. Moreover, if they are used, children tend to become confused later when signed numbers are introduced in upper-grade mathematics and algebra.

When the words *plus* and *equals* are introduced, either orally or in their written form, the question of the grammar involved in stating the basic facts arises. The grammatical rules for stating addition facts are simple and are followed consistently throughout the reading matter in this text. In statements about concrete situations, the verb agrees with the subject (*1 duck* plus 4 ducks *equals* 5 ducks; *4 ducks* plus 1 duck *equal* 5 ducks). With numerals alone, the verb is always singular (*1* plus 4 *equals* 5; *5* plus 2 *equals* 7). The word *plus* is a preposition, not a conjunction. *Children at this level, of course, should not be expected to observe these distinctions.*

Moving forward

On pages 3 to 6 you will learn about the groups that make the numbers 2, 3, 5, and 7.

D 5 boys are playing.
2 boys are coming to play.
Then ■ boys will be playing.
5 boys plus 2 boys equal ■ boys.
5 plus 2 equals ■.

E 6 boys are playing.
1 boy is coming to play.
Then ■ boys will be playing.
6 boys plus 1 boy equal ■ boys.
6 plus 1 equals ■.

F How many girls are playing?
How many girls are coming to play?
Then ■ girls will be playing.
3 girls plus 2 girls equal ■ girls.
3 girls + 2 girls = ■ girls
3 plus 2 equals ■.
3 + 2 = ■

G How many girls are playing?
How many girls are coming to play?
Then ■ girls will be playing.
2 girls plus 5 girls equal ■ girls.
2 girls + 5 girls = ■ girls
2 plus 5 equals ■.
2 + 5 = ■

3

1 For each new block of work, an opening statement such as this one tells children what they are going to learn.

2 Ask specific questions about these three scenes of Movie A to lead pupils to tell the story of the group of 4 girls joining the group of 3 girls to make a larger group. Help them describe this action and the result by using the words *plus* and *equal* (3 girls plus 4 girls equal 7 girls).

3 The same procedure may be used with Movie B.

4 Picture C illustrates several situations in which one group is joining another, but the resulting larger group is not shown. Have pupils imagine that the groups combine and what the results will be. Let them tell each story, using the words *plus* and *equal*. To demonstrate their understanding of each situation, have pupils use objects (buttons, corks, etc.) to show the two groups involved, what happens, and the size of the combined group in each case.

4

1 Tell pupils to imagine the larger group that will result when the two groups have combined. They may use objects if necessary. Ask them to tell what happens by using *plus* and *equal*. Tell them to say the missing numbers as they read the accompanying story aloud.

2 Treat this picture and text in the same way.

3 Introduce this picture in the same way. Then write the plus sign under the word *plus* and the equals sign under the word *equals* on the board. Explain that each sign has the same meaning as the word above it. Next have pupils read the story, answering the questions and supplying the numbers.

4 Follow the same procedure for this picture and its story. To help children realize that 2+5=7 describes many other situations in which groups of 2 and 5 are combined, give them more experiences with other situations involving groups of 2 and 5. The other basic facts should be illustrated in the same way.

H How many boys are playing ball?
How many boys are coming to play?
Then ▪ boys will be playing ball.
4 boys plus 3 boys equal ▪ boys.
4 boys + 3 boys = ▪ boys
4 plus 3 = ▪
Add 3 to 4. 4 + 3 = ▪

I How many boys are playing?
How many boys are coming to play?
Then ▪ boys will be playing.
5 boys + 2 boys = ▪ boys
5 plus 2 = ▪
Add 2 to 5. 5 + 2 = ▪

J How many boys are carrying the box?
How many boys are coming to help?
Then there will be ▪ boys.
2 boys + 3 boys = ▪ boys
2 plus 3 = ▪
Add 3 to 2. 2 + 3 = ▪

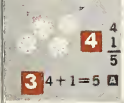
K How many boys are playing ball?
How many boys are coming to play?
Then there will be ▪ boys.
1 boy + 6 boys = ▪ boys
1 plus 6 = ▪
Add 6 to 1. 1 + 6 = ▪

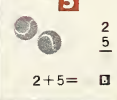
5

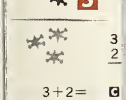
1 Ask questions that help children determine the size of the group that results when the group of 3 boys joins the group of 4 boys. Then have them put a group of 3 markers with a group of 4. Tell them that when they do this, they *add* 3 to 4. Explain that *add* means to join or put with.

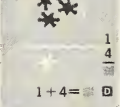
2 Remind the children to look at the picture to find the answers to the questions in the reading material. Tell them to say the missing numbers to themselves as they read. Call on someone to read the story aloud.

3 This picture and its story may be handled in the same way.









A 4 balls plus 1 ball equal ▪ balls.
D 5 jacks plus 2 jacks equal ▪ jacks.
G 1 jack plus 4 jacks equals ▪ jacks.
2
D 2 balls plus 5 balls equal ▪ balls.
E 3 balls plus 4 balls equal ▪ balls.
F 3 jacks plus 2 jacks equal ▪ jacks.

A 5 + 2 = ▪
B 1 + 4 = ▪
C 2 + 3 = ▪
D 1 + 6 = ▪
E 2 + 1 = ▪
F 3 + 2 = ▪
G 6 + 1 = ▪
6
H 2 + 5 = ▪
I 4 + 3 = ▪
J 1 + 2 = ▪
K 4 + 1 = ▪
L 1 + 1 = ▪
M 3 + 4 = ▪
N 5 + 2 = ▪

Add

A	B	C	D	E	F
4	3	6	1	4	1
1	2	1	1	3	6
▪	▪	▪	▪	▪	▪

7

G	H	I	J	K	L
2	3	5	1	1	2
1	4	2	2	4	3
▪	▪	▪	▪	▪	▪

M	N	O	P	Q	R
2	6	3	5	4	3
5	1	4	2	3	2
▪	▪	▪	▪	▪	▪

Now you should know how to add the numbers that make 2, 3, 5, and 7.

6

1 Ask pupils what is happening in this picture and how many balls there will be altogether when the two groups are joined.

2 Have them find and read the story that describes Picture A.

3 Tell the children that 4 + 1 = 5 also tells the story of what happened. Explain that we call this combination of numbers and signs an *equation* and that they can find it printed in Picture A.

4 Tell the pupils that there is another way to write this same story and that they can find it printed in Picture A, too.

5 Use the above four steps with this picture.

6 Pupils may either write these exercises or take turns reading them aloud, including the answers. If you prefer, they may give only the answers.

7 These exercises may be handled in the same way as Exercises A to N. The children may write them in equation form with answers.

7 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

On this page the child finds out how well he knows the addition basic facts for the 2, 3, 5, and 7 groups.

Vocabulary

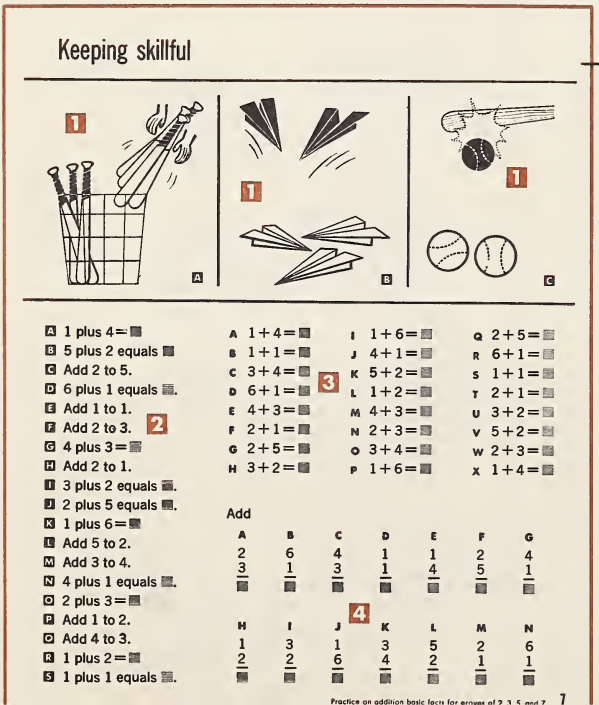
There is no additional vocabulary.

Comments

The children's knowledge of the addition basic facts for the 2, 3, 5, and 7 groups is tested by pictures, printed words and signs, the equation form, and the computational form.

Children who need to use objects to find answers may be allowed to do so. In fact, an excellent way to determine whether all the children understand the *meaning* of the addition basic facts studied so far is to have each child demonstrate with objects the additive situations presented in Exercises A to X (blue). Those who do not arrive at the right answers when working with objects probably need more help in learning to recognize the size of groups. They should be encouraged to arrange 2, 3, 5, and then 7 objects in two groups in as many ways as possible, noting in each case the size of the groups involved. Next they should be given experiences with the action of combining each of these pairs of subgroups into one group. They might also be given help in restudying pages 4 and 5.

In starting page 7, be sure to call the children's attention to the heading "Keeping skillful." Tell them that whenever they see these words, they will know that they are going to have some practice using what they have been learning. They will find out which facts and skills they need to practice more.



Keeping skillful

1

A

1

B

1

C

A 1 plus 4= ■
B 5 plus 2 equals ■
C Add 2 to 5.
D 6 plus 1 equals ■.
E Add 1 to 1.
F Add 2 to 3.
G 4 plus 3= ■
H Add 2 to 1.
I 3 plus 2 equals ■.
J 2 plus 5 equals ■.
K 1 plus 6= ■
L Add 5 to 2.
M Add 3 to 4.
N 4 plus 1 equals ■.
O 2 plus 3= ■
P Add 1 to 2.
Q Add 4 to 3.
R 1 plus 2= ■
S 1 plus 1 equals ■.

2

3

A 1+4= ■
B 1+1= ■
C 3+4= ■
D 6+1= ■
E 4+3= ■
F 2+1= ■
G 2+5= ■
H 3+2= ■
I 1+6= ■
J 4+1= ■
K 5+2= ■
L 1+2= ■
M 4+3= ■
N 2+3= ■
O 3+4= ■
P 1+6= ■
Q 2+5= ■
R 6+1= ■
S 1+1= ■
T 2+1= ■
U 3+2= ■
V 5+2= ■
W 2+3= ■
X 1+4= ■

Add

4

A	B	C	D	E	F	G
2	6	4	1	1	2	4
3	1	3	1	4	5	1
■	■	■	■	■	■	■

H	I	J	K	L	M	N
1	3	1	3	5	2	6
2	2	6	4	2	1	1
■	■	■	■	■	■	■

Practice on addition basic facts for groups of 2, 3, 5, and 7 7

7

1 For each picture ask the children to imagine the two groups combined and to tell what size group resulted. Let them tell each story, using the words *plus* and *equal*. Then have them repeat the stories, leaving out the names of the objects in the pictures. Explain that in doing this they are changing each story into an equation that describes all similar situations.

2 The children may take turns reading aloud and giving the answers, or they may place the letters A to S in a column on their papers and write the answers. For the statements that begin with *Add*, tell them either to supply the equations they need to find the answers or simply to give the answers.

3 The children may take turns reading the equations A to X orally and giving the answers. If you wish, ask them to write out the complete exercise.

4 The same procedures may be applied.

8-12 Moving forward

Expanded Notes for this lesson are on pages 210-214.

Objectives

The child learns the meaning of subtraction and is taught to recognize subtractive situations. He becomes acquainted with the subtraction basic facts for the 2, 3, 5, and 7 groups (the basic facts whose minuends are 2, 3, 5, and 7).

Vocabulary

New words page 8 find*, when*; page 9 them*, Betty*; page 10 painting*, reading*

Old words page 8 left*, a*, away*, taken*, from*, or*; page 9 pictures*, were*, table*, Nancy*, minus, Tom*, Don, of*; page 10 going*, subtract, books*, planting*, flowers*; page 11 dogs*

You will want to use the words *minus* and *subtract* in oral situations before the children meet them in their reading.

Comments

In the previous lessons the children learned how groups of 2, 3, 5, and 7 can be formed by combining two smaller groups. Now they learn that each of these groups can be separated into two smaller groups and that if one group is removed, the remainder can be determined.

Movies A and B on page 8 introduce the subtractive situation. In three scenes, the children see the total group, the separating into two groups, and the group that remains. Guided oral work helps them describe, with the proper arithmetic vocabulary, what they see happening. In Picture C they see the separating actions taking place. They must imagine the result of the action and determine the size of the remaining group. The subtraction basic facts for 5—2, 7—3, 5—4, 7—2, 3—1, 7—4, 5—3, and 3—2 are presented pictorially.

On page 9 children learn to read, with the aid of accompanying pictures, the equation form that expresses subtractive actions and their results. From each story they learn the basic fact that covers all subtractive situations involving those particular numbers. Subtraction basic facts for 7—3, 7—5, 7—6, and 7—1 are presented.

On page 10 the children meet the word *subtract* in the text. The subtraction basic facts for 2—1 and 5—1 are presented through specific illustrations for the first time.

On page 11 the subtraction basic facts studied so far are reviewed, and the computational form for subtraction is introduced.

Page 12 provides practice on all the subtraction basic facts for the 2, 3, 5, and 7 groups.

In stating subtraction basic facts, you should keep in mind the fact that the word *minus* is a preposition, and that in concrete statements the subject is always plural. You should, therefore, use the plural verb *equal,* not the singular *equals* (5 ducks minus 1 duck *equal* 4 ducks). In abstract statements the verb is always singular (5 minus 1 *equals* 4). Children, of course, are not expected to observe these distinctions, but correct usage in the text and by the teacher should set good examples.

Note also that the subtraction basic facts are presented by means of the "How many are left?" or remainder type of problem: "John had 5 cookies. He gave 3 away. How many did he have left?" This is the simplest type of problem to use in teaching children what happens in subtractive situations because the actions involved can be clearly demonstrated. Other types of problems involving subtraction (see *Seeing Through Arithmetic 3,* pages 72-78) are introduced in later problem situations.

Moving forward

On pages 8 to 12 you will learn to find how many are left when a group is taken away from 2, 3, 5, or 7.

8 The subtraction basic facts for groups of 2, 3, 5, and 7

D 7 pictures were on the table.
Nancy is taking 3 of them away.
Then ■ pictures will be left.
7 pictures minus 3 pictures equal ■ pictures. 2
7 minus 3 equals ■.

E 7 boxes were on the table.
Tom is taking 5 of them away.
Then ■ boxes will be left.
7 boxes minus 5 boxes equal ■ boxes.
7 minus 5 equals ■.

F How many boxes were on the table?
How many is Don taking away?
Then ■ box will be left.
7 boxes minus 6 boxes equal ■ box.
7 boxes − 6 boxes = ■ box
7 minus 6 equals ■.
7 − 6 = ■

G How many pictures were on the table?
How many is Betty taking away?
Then ■ pictures will be left.
7 pictures minus 1 picture equal ■ pictures.
7 pictures − 1 picture = ■ pictures
7 minus 1 equals ■.
7 − 1 = ■

8

1 Tell the children to read the "Moving forward" section to find out what they are going to learn.

2 Have the pupils examine Movie A carefully. Tell them to notice how many children there are at first, how many are going away, and how many are left. Ask them to describe what happens by using the words *minus* and *equal*.

3 Movie B may be treated in the same way. Try to begin using the word *subtract* in questions and discussions, so that children will be familiar with its use when they meet it in the text on page 10.

4 Tell the children to imagine that all the separating actions taking place are completed. Ask them how many objects are left in each group. If necessary, show them how to use objects to arrive at their answers. Require them to use the words *minus* and *equal* in expressing the complete stories about what takes place.

9

1 Give the children help in determining the size of the original group of pictures on the table, and the size of the group that will remain when the separating action is completed. Ask them to tell this story by using the words *minus* and *equal*.

2 Have the children supply the missing numbers as they read this story. Provide other experiences with situations in which a group of 3 is separated from a group of 7, so that the children will see that "7 minus 3 equals 4" can be used to describe all subtractive situations involving groups of these sizes.

3 Use the above two steps in working with Picture E and its story.

4 Proceed with Pictures F and G and their stories in the same way. First introduce the sign for *minus* on the chalkboard and explain that the word and sign mean the same.

H 2 girls were painting pictures.
How many girls are going away?
Then ■ girl will be painting.
2 girls minus 1 girl equal ■ girl.
2 girls − 1 girl = ■ girl
2 minus 1 = ■
Subtract 1 from 2. 2 − 1 = ■

I 7 boys were making books.
How many boys are going away?
Then ■ boys will be making books.
7 boys − 4 boys = ■ boys
7 minus 4 = ■
Subtract 4 from 7. 7 − 4 = ■

J 5 girls were planting flowers.
How many girls are going away?
Then ■ girls will be planting flowers.
5 girls − 1 girl = ■ girls
5 minus 1 = ■
Subtract 1 from 5. 5 − 1 = ■

K 7 boys were reading.
How many boys are going away?
Then ■ boys will be reading.
7 minus 5 = ■
Subtract 5 from 7. 7 − 5 = ■

10

1 Tell the children to imagine that the action in Picture H is completed and ask them how many girls remain. Then ask them to tell the story by using *minus* and *equal*.

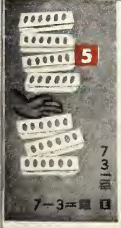
2 Present the word *subtract* before the children read this story. One way to do this is to ask them to illustrate the total group in Picture H with objects. Then tell them to "subtract" 1. Explain that *subtract* means to take away. Write the word *subtract* on the board.

3 Have children tell their own stories about this picture, then read the story at the right. The goal is to have them develop an understanding of abstract phrases such as "subtract 4 from 7." See Expanded Notes for additional activities.

A 7 dogs minus 4 dogs equal ■ dogs.
B 5 dogs minus 2 dogs equal ■ dogs.
C 7 boxes minus 6 boxes equal ■ box.
D 3 dogs minus 2 dogs equal ■ dog.
E 7 boxes minus 1 box equal ■ boxes.
F 7 boxes minus 3 boxes equal ■ boxes.

A 3 − 2 = ■
B 2 − 1 = ■
C 7 − 3 = ■
D 7 − 6 = ■
E 7 − 2 = ■
F 3 − 1 = ■
G 5 − 3 = ■
H 5 − 2 = ■
I 7 − 4 = ■
J 7 − 5 = ■

K 7 − 1 = ■
L 5 − 1 = ■
M 7 − 3 = ■
N 5 − 4 = ■
O 7 − 6 = ■
P 3 − 2 = ■
Q 7 − 5 = ■
R 5 − 2 = ■
S 7 − 2 = ■
T 7 − 4 = ■



Subtract

A	B	C	D	E	F
5	7	7	5	7	3
3	1	2	4	6	2
■	■	■	■	■	■

G	H	I	J	K	L
7	5	7	5	7	2
5	2	3	1	4	1
■	■	■	■	■	■

M	N	O	P	Q	R
3	5	7	5	7	3
1	3	5	4	2	1
■	■	■	■	■	■

11

1 Ask the children to determine the size of the group that will remain when the separating action is completed in Picture A. They are to tell the story of the picture by using *minus* and *equal*.

2 Have them find and read the story that describes Picture A.

3 Ask them to point out the equation form of the story that is printed in this picture.

4 Point out that this form is another way of writing the same story.

5 Go through the steps suggested above for these remaining pictures.

6 Exercises A to T may be done orally. Let the children take turns reading and answering the exercises. All the children may then copy the equations with the labeling letters and supply the answers, or they may write just the answers.

7 The above procedures may be applied to Exercises A to R.

A 7 minus 5 equals ■.
B Subtract 2 from 5.
C Subtract 1 from 3.
D 5 minus 1 = ■
E 7 minus 2 equals ■.
F 2 minus 1 equals ■.
G Subtract 3 from 7.
H Subtract 4 from 5.
I 5 minus 3 = ■
J Subtract 2 from 3.
K Subtract 6 from 7.
L 7 minus 4 = ■
M Subtract 1 from 7.
N 5 minus 2 equals ■.
O 3 minus 1 = ■
P Subtract 2 from 7.
Q 7 minus 5 equals ■.
R Subtract 1 from 2.
S 7 minus 6 = ■

2

A	B	C	D	E	F	G
7−3=■	7−5=■	5−1=■	7−2=■	3−2=■	7−1=■	5−2=■
H	I	J	K	L	M	N
7−4=■	2−1=■	5−3=■	7−4=■	3−1=■	5−4=■	7−3=■
O	P	Q	R	S	T	U
5−1=■	7−6=■	7−2=■	3−1=■	5−3=■	7−5=■	3−2=■
V	W	X				
7−6=■	5−4=■	7−1=■				

3

Subtract

A	B	C	D	E	F	G
7	5	7	7	2	5	3
3	1	6	2	1	2	1
■	■	■	■	■	■	■

4

H	I	J	K	L	M	N
7	3	5	7	5	7	7
4	2	4	1	3	5	6
■	■	■	■	■	■	■

5 Now you should know how to subtract from the numbers 2, 3, 5, and 7.

12

12

1 Have the children imagine the completed action in each of the pictures A to C. Ask them to describe what is happening and the result by using *minus* and *equal*.

2 The children may take turns giving answers, or they may all write out the complete equations including the answers. In examples such as "Subtract 2 from 5" the child should supply the equation as well as the answer.

3 Exercises A to X may also be done in either oral or written form. If you wish, ask the pupils to give only the answers.

4 Exercises A to N on the computational form may be done orally. The children may then copy the exercises with their labels and supply the answers in place of the screens.

5 Have the children read this statement about what they have learned in these lessons.

13 Keeping skillful

Exponded Notes ore not considered necessory for this lesson.

Objectives

With this page the child practices recall of the addition and subtraction basic facts for the 2, 3, 5, and 7 groups.

Vocabulary

There is no additional vocabulary.

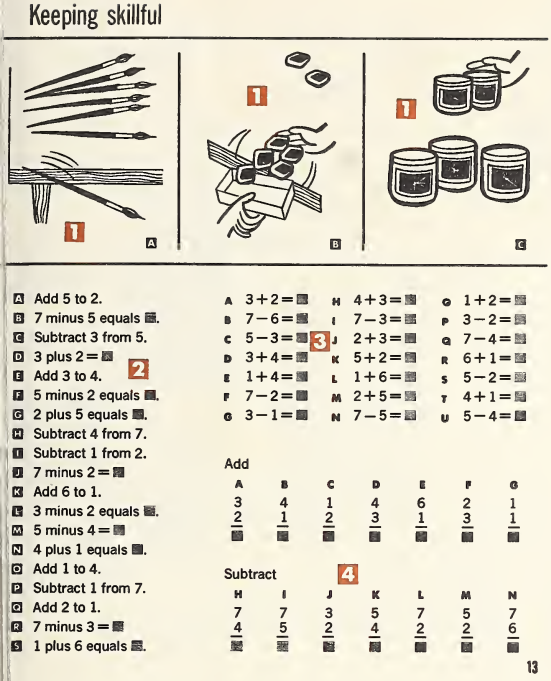
Comments

On this page, for the first time, children meet a mixture of addition and subtraction basic facts. The three pictures, A, B, and C, test their understanding of the action meanings (combining for addition and separating for subtraction). Exercises A to S (white) test their understanding of printed words and signs. The equation form of the addition and subtraction basic facts is covered in Exercises A to U (blue). The computational form of the addition and subtraction basic facts is covered in Exercises A to N (black).

Before work with this page is started, it would be helpful to use the color sound film *The Meaning of Plus and Minus.** This film helps children associate the correct action meanings with the words *plus* and *minus* and the signs + and −.

Children who experience difficulty in distinguishing between pictured subtractive and additive situations or in remembering the basic facts could profitably spend time working with the story and picture-card activities on the card-holder chart. (See Activity 3, page 313.) The addition and subtraction basic fact story cards should be mixed, and the children directed to take turns illustrating the stories they select.

* *The Meaning of Plus and Minus.* Eleven-minute film in full color available from Encyclopaedia Britannica Films, Wilmette, Illinois, or from regional EBF libraries in New York, Dallas, Hollywood, Atlanta. This film was produced by Encyclopaedia Britannica Films, in collaboration with Maurice L. Hartung, Henry Van Engen, and Catherine Mahoney.


Keeping skillful
1
A
1
B
1
C
A Add 5 to 2.
B 7 minus 5 equals ■.
C Subtract 3 from 5.
D 3 plus 2 = ■
E Add 3 to 4.
F 5 minus 2 equals ■.
G 2 plus 5 equals ■.
H Subtract 4 from 7.
I Subtract 1 from 2.
J 7 minus 2 = ■
K Add 6 to 1.
L 3 minus 2 equals ■.
M 5 minus 4 = ■
N 4 plus 1 equals ■.
O Add 1 to 4.
P Subtract 1 from 7.
Q Add 2 to 1.
R 7 minus 3 = ■
S 1 plus 6 equals ■.
2
A 3+2=■ H 4+3=■ O 1+2=■
B 7−6=■ I 7−3=■ P 3−2=■
C 5−3=■ 3 J 2+3=■ Q 7−4=■
D 3+4=■ K 5+2=■ R 6+1=■
E 1+4=■ L 1+6=■ S 5−2=■
F 7−2=■ M 2+5=■ T 4+1=■
G 3−1=■ N 7−5=■ U 5−4=■
Add
A B C D E F G
3 4 1 4 6 2 1
2 1 2 3 1 3 1
■ ■ ■ ■ ■ ■ ■
Subtract 4
H I J K L M N
7 7 3 5 7 5 7
4 5 2 4 2 2 6
■ ■ ■ ■ ■ ■ ■
13

13

1 Ask your pupils to look at Pictures A, B, and C and to be ready to tell you which one shows groups joining and which show groups separating. Then call upon pupils to tell the story of each picture, using the words *plus*, *minus*, and *equal*. When each story is completed, ask the pupil telling it to change it into the fact or statement that covers *all* similar stories (7−1=6, 7−5=2, 3+2=5).

2 Have the children take turns reading and answering orally Exercises A to S. Then, if you wish, you may have them write the equations with the answers or just the answers.

3 The children may read the equation forms A to U orally, then write each equation and its answer, or just the answer, on paper.

4 The addition and subtraction basic facts in computational form, A to N, may be copied and answered on paper, or the children may supply just the answers. Also ask the children to write each example in equation form.

14-16 Moving forward

Expanded Notes for this lesson are on pages 215-217.

Objectives

The child learns the addition and subtraction basic facts for the 4 and 6 groups (basic facts whose sums and minuends are 4 and 6).

Vocabulary

New words page 14 also, hat*, cups, birthday*, candles

Old words page 14 Carol, more*, putting*

Comments

For the first time within one block of work children are introduced to both the addition and subtraction basic facts for the groups studied. Eight new addition basic facts and eight new subtraction basic facts are presented in studying the 4 and 6 groups.

On page 14, children meet the addition basic facts for 4+2, 1+3, 3+3, and 2+4 in pictorial form, in equation form, and in expressions such as "Add 4 to 2."

Page 15 introduces the subtraction basic facts in the same way. Those presented are for 6−4, 4−3, 6−3, and 4−2.

Page 16 presents the basic facts for 3+1, 1+5, 2+2, 6−2, 6−5, 6−1. Practice is also provided on the equation and computational forms for all facts introduced on pages 14, 15, and 16.

Moving forward

You will learn how to add the numbers that make 4 and 6.
You will also learn how to subtract from 4 and from 6.

B 1 hat is on the table.
Betty is putting 3 more hats on the table. 4
Then ■ hats will be on the table.
Add 3 to 1. 1 + 3 = ■

C How many cups are on the table?
Nancy is putting ■ more cups on the table.
Then ■ cups will be on the table.
Add 3 to 3. 3 + 3 = ■

D How many birthday candles are on the table?
Carol is putting ■ more candles on the table.
Then ■ candles will be on the table.
Add 4 to 2. 2 + 4 = ■

F 4 birthday candles were on the table.
How many candles is Nancy taking away?
Then ■ candle will be on the table.
Subtract 3 from 4. 4 − 3 = ■

G 6 cups were on the table.
How many cups is Carol taking away?
Then ■ cups will be on the table.
Subtract 3 from 6. 6 − 3 = ■

H 4 hats were on the table.
How many hats is Betty taking away?
Then ■ hats will be on the table.
Subtract 2 from 4. 4 − 2 = ■

14

1 Have the children read the "Moving forward" section to find out what they are going to learn. Then ask them to look at all the pictures to see if they can discover whether this is a page on adding, subtracting, or both.

2 Ask questions about Movie A that will help the children express the pictured action and result as "4 girls plus 2 girls equal 6 girls." Let them dramatize the story.

3 Have the children tell the story of what is happening and the result in their own words.

4 Direct the children to refer to the picture as they read this story. They should get the missing numbers by looking at the picture.

5 Proceed in the same way with this picture and its accompanying story.

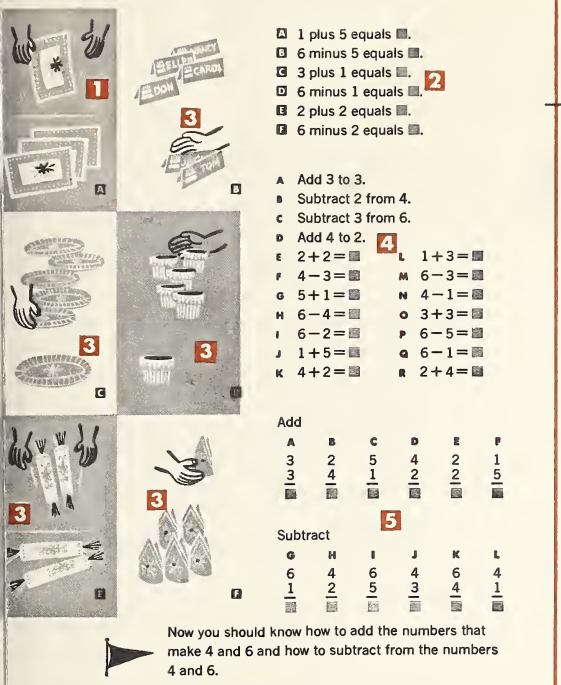
15

1 Ask questions about Movie E that will lead the children to express the pictured action and result as "6 girls minus 4 girls equal 2 girls." Let them dramatize the story.

2 Have the children tell the story of what is happening in the picture and the result.

3 Tell them to read this story. Be sure they refer to the picture as they read and use it to get the missing numbers.

4 Proceed in the same way with this picture and its accompanying story.



16

1 Have the children describe what is happening in this picture and the result.

2 Have them find the story that matches Picture A among these statements. Since these are abstract versions, some of the children may need further questions and activities with objects to enable them to respond with understanding. Permit them to state each story more concretely (1 cupcake plus 5 cupcakes equals 6 cupcakes).

3 Follow Notes 1 and 2 for the remaining pictures.

4 The children may do Exercises A to R orally before they are asked to write the answers on paper.

5 The answers to Exercises A to L may be given orally, written on paper, or both. You may also require that the children write these in equation form with the answers.

7-18 Moving forward

panded Notes for this lesson are on pages 217-219.

bjectives

he child learns to recognize multiplicative situations. e learns the meaning of multiplication and becomes cquainted with the multiplication basic facts for the 4 nd 6 groups (basic facts whose products are 4 and 6).

ocabulary

ew words page 17 together*; page 18 multiplied, y*, means*

ld words page 18 each*, eat*, frogs, have*, in*, ond*, three*, two*, kittens*

e sure to use *multiplied by* orally in connection with e work on page 17.

mments

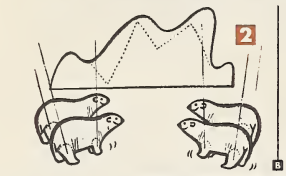
ne danger that you should be alert to in introducing e multiplication basic facts is that children may think multiplicative situations as additive situations. In the ultiplicative situation, there are two or more groups of *equal* size. They are joined together to make one larger group. Be sure children observe not only the equality and size of the groups, but also the number of groups that are being combined. In the additive situation one group is thought of as being put with another group, but they are not necessarily equal.

The multiplication basic facts presented on pages 17 and 18 are for 2×3, 3×2, and 2×2. Page 17 introduces each basic fact through pictures of two scenes each. One scene shows the combining action, and the other shows the result. Guided oral work should help children describe with the proper arithmetic vocabulary what they see happening and the result. From expressions about concrete situations such as "3 groups of 2 puppets equal 6 puppets," they are led to an understanding of expressions such as "3 groups of 2 equal 6," "3 twos equal 6," and "2 multiplied by 3 equals 6." The word *times* is purposely delayed until page 23.

Page 18 provides experiences that help children learn to read the expressions they have been using orally.

Moving forward

On pages 17 and 18 you will learn how to put equal groups together to make groups of 4 and 6.



2 groups of frogs are going to the pond.
There are 3 frogs in each group.
There will be ■ frogs in the pond.

2 groups of 3 frogs equal ■ frogs.
2 groups of 3 equal 2 threes.
2 threes = ■
2 threes means 3 multiplied by 2.
3 multiplied by 2 = ■

How many groups of kittens are coming to play?
How many kittens are in each group?
Then ■ kittens will be playing.

2 groups of 2 kittens equal ■ kittens.
2 twos = ■
2 multiplied by 2 = ■

How many groups of dogs are coming to eat?
How many dogs are in each group?
Then ■ dogs will be eating.

3 groups of 2 dogs equal ■ dogs.
3 twos = ■
2 multiplied by 3 = ■

Now you have learned how to make groups of 4 and 6 by putting together equal groups.

17

1 Tell pupils to look at Movie A. Ask questions that lead them to note how many are in each group, that the groups are equal, the number of equal groups, the kind of action taking place, and the result when the action is completed. Guide them in using expressions like the following: "3 groups of 2 puppets equal 6 puppets," "3 groups of 2 equal 6," "3 twos equal 6," and "2 multiplied by 3 equals 6." Go from the concrete situation to the abstract in this order.

2 Proceed along the same lines for this movie. Have the children act out the stories or use objects to make sure they understand the kind of action involved and the results of the simultaneous combination of equal groups.

18

1 Direct the children's attention to the picture. Ask such questions as: "How many frogs are in each group? How many groups of frog puppets do you see here?" Then ask the children to use objects on their desks arranged as the frog puppets are. Tell them to use both hands to push all the objects together into one group. Be sure both groups are moved, not one group to the other as in additive situations. Ask how many frogs there are in all.

2 Have the children read this story silently. Then have them take turns reading it aloud, saying the missing numbers. They should refer to the picture as they read and get the missing numbers from the picture.

3 Follow the above steps in working with this picture and its story.

19-20 Moving forward

Expanded Notes for this lesson are on pages 219-220.

Objectives

The child learns to recognize divisive situations. He learns the meaning of division and becomes acquainted with the division basic facts for the 4 and 6 groups (the basic facts whose dividends are 4 and 6).

Vocabulary

New words page 19 separate; page 20 lambs, dividing

Old words page 20 garden*, can*, rabbits*, squirrels*, they*

Be sure to use *dividing* and *divided by* orally in connection with the work on page 19.

Comments

In this block of work children round out their knowledge about the 4 and 6 groups. In previous lessons they have learned that groups of 4 and 6 can be formed by joining one subgroup to another, that groups of 4 and 6 can be separated into two subgroups, that when one subgroup is removed the remainder can be determined, and that groups of 4 and 6 can each be formed by combining equal groups. Now they learn that groups of 4 and groups of 6 can each be separated into smaller equal groups.

Take care that children do not confuse the actions of subtraction with those of division. Both involve actions of separating a group into subgroups. In subtraction one of the subgroups is separated *from* the other and no attention is given to the question of whether the subgroups are equal or unequal. Interest is centered on the size of the remaining group. In division attention is focused on the equality of the subgroups. In division the entire group is separated, and interest is centered on the size of the equal groups resulting as well as in the number of such groups. By initially presenting an example that involves a separation into three equal groups ($\div 2 = 3$), the tendency to confuse subtractive actions with divisive actions is lessened. Have children use objects to illustrate the action of separating groups into equal subgroups. To help distinguish the situation from the subtractive ones, insist that children move all equal groups and not let one remain unmoved.

To simplify the learning of the basic facts of division, only one type of divisive situation is presented: finding how many equal groups there are. Divisive situations in which the size of the equal groups (how many are there in each group) is to be determined are introduced at a later time (pages 134-138 of the pupil's book).

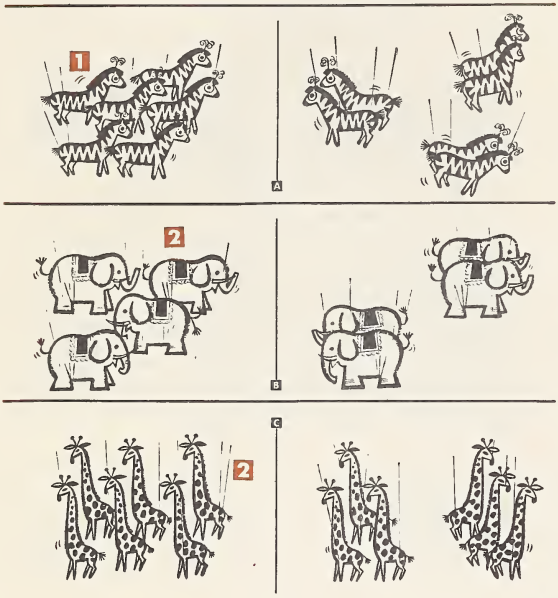
The division basic facts presented on pages 19 and 20 are for $6 \div 2$, $6 \div 3$, and $4 \div 2$.

Page 19 introduces these facts through pictorial situations. Guided oral work helps children progress from statements about concrete situations such as "6 puppets are separating into 3 groups of 2 puppets," to abstract statements such as "6 divided by 2 equals 3."

Page 20 provides experiences that help children learn to read, with the aid of accompanying pictures, the expressions they have been using orally.

Moving forward

On pages 19 and 20 you will learn how to separate groups of 4 and 6 into equal groups.



6 lambs were playing.
Now they are separating into groups of 3.
The 6 lambs are dividing into groups of 3.
There are 2 groups of 3 lambs. 2

6 divided into threes means 6 divided by 3.
6 divided by 3 = ■

6 squirrels were playing.
Now they are separating into groups of ■.
They are dividing into ■ groups of 2.
How many groups of 2 squirrels are there?

6 divided into twos means 6 divided by 2.
6 divided by 2 = ■

4 rabbits were eating in the garden.
Now they are separating into groups of ■.
They are dividing into ■ groups of 2.
How many groups of 2 rabbits are there?

4 divided into twos means 4 divided by 2.
4 divided by 2 = ■

Now you have learned how groups of 4 and 6 can be divided into equal groups.

19

1 Before working with Movie A, have the children use objects to see if they can discover into how many equal groups 6 and 4 can be separated. Then ask questions about each scene of Movie A that lead children to note how many puppets there were at first, the kind of action taking place, how many are in each of the groups that are separating, the fact that the groups are equal, and the number of equal groups. Guide them in using such expressions as: "6 zebras are separating into groups of 2 zebras," "6 zebras are separating into 3 groups of 2 zebras," "6 zebras are dividing into 3 groups of 2 zebras," "6 zebras divided into groups of 2 zebras equal 3 groups." Go from the concrete form to the abstract situation in this order.

2 Proceed along the same lines for this picture. Work toward the abstract expression of the basic fact.

20

1 Direct the children's attention to Picture D. Ask such questions as: "How many lambs were there altogether before they started to separate? How many lambs are in each group? How many groups of 3 are there?" Be sure they think of both groups as moved, not just one group. Be sure they understand that neither group is removed and that the thing to discover is the number of equal groups.

2 Have the children read this story silently, using the picture to find the answer. Then have them take turns reading each line aloud, saying the missing number. To make sure that they understand abstract forms such as "6 divided by 3 = 2," ask them to name other objects in the room for which the 6 in this statement could stand.

3 Follow steps 1 and 2 in working with this picture.

21-25 Moving forward

Expanded Notes for this lesson are on pages 220-222.

Objectives

The child becomes acquainted with the addition, subtraction, multiplication, and division basic facts for the 8 group (the basic facts whose sums, minuends, products, and dividends are 8).

Vocabulary

New words page 21 saws*, wheels, hammers*; page 22 spools; page 23 times*; page 24 tops*; page 25 gave*

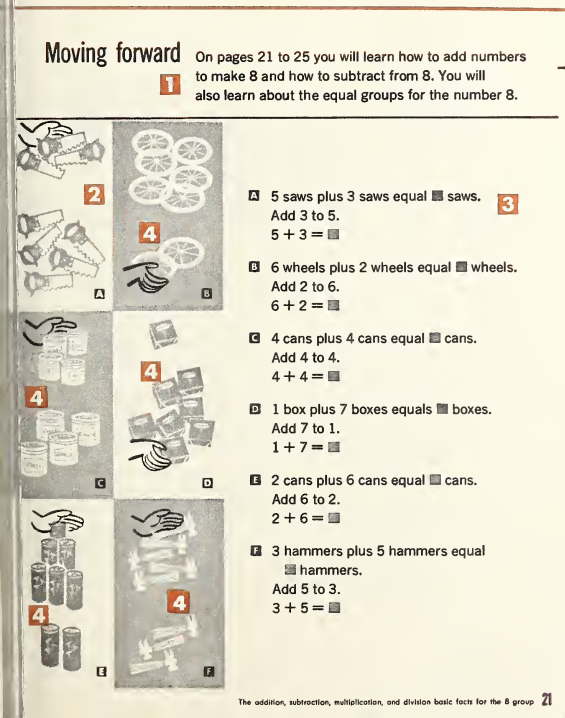
Old words page 21 for*; page 23 four*; page 24 Billy*, dolls*, has*, he*, she*; page 25 Ellen,* had*

Comments

Now that each of the four processes has been introduced, the basic facts for all four processes will be taught in one lesson for each group through 18.

On page 21, pupils meet some of the addition basic facts in pictorial form, in verbal form (5 saws plus 3 saws equal 8 saws), and in abstract form (Add 3 to 5, 5+3=8). On page 22 some of the subtraction basic facts are presented in the same way. Page 23 introduces all the multiplication basic facts. The word *times* is introduced. Page 24 presents all the division basic facts. Page 25 presents pictorially the remaining addition and subtraction basic facts. Practice is also provided on the various ways of stating the basic facts.

Continue to give the children as much experience as possible in combining and separating groups of objects. Use whatever material is available in the schoolroom. Be sure to have them move only one group in additive and subtractive situations and all groups in multiplicative and divisive situations. This will help the children recognize the difference between additive and multiplicative situations, as well as between subtractive and divisive situations. Stress consciousness of the equality of the groups in the multiplicative and divisive situations. Be sure children know that the number at the left of the word *times* is the number of groups, not the size of the equal groups.


Moving forward
1
On pages 21 to 25 you will learn how to add numbers to make 8 and how to subtract from 8. You will also learn about the equal groups for the number 8.
2
4
A
B
3
A 5 saws plus 3 saws equal ■ saws.
Add 3 to 5.
5 + 3 = ■
B 6 wheels plus 2 wheels equal ■ wheels.
Add 2 to 6.
6 + 2 = ■
C 4 cans plus 4 cans equal ■ cans.
Add 4 to 4.
4 + 4 = ■
D 1 box plus 7 boxes equals ■ boxes.
Add 7 to 1.
1 + 7 = ■
E 2 cans plus 6 cans equal ■ cans.
Add 6 to 2.
2 + 6 = ■
F 3 hammers plus 5 hammers equal ■ hammers.
Add 5 to 3.
3 + 5 = ■
The addition, subtraction, multiplication, and division basic facts for the 8 group
21

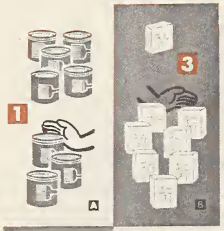
21

1 Have the children read the "Moving forward" section to find out what new things they are going to learn.

2 Direct the children to look at the picture. Ask questions that will help them determine how many objects there are in each group and what is happening. You may also have the children use objects on their desks to show the groupings and to complete the action shown in the picture.

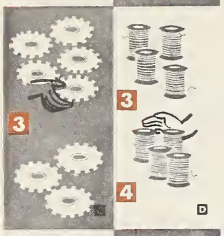
3 Have the children supply the answers as they read the story silently or aloud. They should refer to the picture as they read and get the missing numbers from it.

4 Use the same procedures with this picture and its accompanying text.



A 8 cans minus 3 cans equal ▪ cans.
Subtract 3 from 8.
8 − 3 = ▪

D 8 boxes minus 7 boxes equal ▪ box.
Subtract 7 from 8.
8 − 7 = ▪



C 8 wheels minus 5 wheels equal ▪ wheels.
Subtract 5 from 8.
8 − 5 = ▪

D 8 spools minus 4 spools equal ▪ spools.
Subtract 4 from 8.
8 − 4 = ▪

E 8 hammers minus 1 hammer equal ▪ hammers.
Subtract 1 from 8.
8 − 1 = ▪

F 8 cans minus 6 cans equal ▪ cans.
Subtract 6 from 8.
8 − 6 = ▪

22

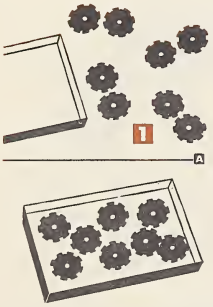
22

1 Direct the children to look at the picture. Ask questions that will help them determine how many objects there were in the group at first, what action is taking place, how many objects are being taken away, and how many will be left. You may also have the children use objects on their desks or objects in the room to show what is happening in the picture.

2 Have the children supply the missing numbers as they read the story silently or aloud. Be sure they refer to the picture as they read and get the numbers from it.

3 Use the same procedures with this picture and its accompanying text.

4 In working with this picture, be sure the children understand why it is a subtractive, not divisive, situation. Only one group is moved, and interest is focused on the remainder only.



How many groups of wheels are on the table?
How many wheels are in each group?
Nancy put the wheels into a box.
Now how many wheels are in the box?

4 groups of 2 = ▪
4 twos = ▪
2 multiplied by 4 = ▪
Multiply 2 by 4.
2 multiplied by 4 means 4 times 2.
4 times 2 = ▪

How many groups of spools are on the table?
How many spools are in each group?
Tom put the spools into a box.
Now how many spools are in the box?

2 groups of 4 = ▪
2 fours = ▪
4 multiplied by 2 = ▪
Multiply 4 by 2.
4 multiplied by 2 means 2 times 4.
2 times 4 = ▪

A Multiply 4 by 2. 2 times 4 = ▪
B Multiply 2 by 2. 2 times 2 = ▪
C Multiply 2 by 4. 4 times 2 = ▪

23

23

1 Have the children examine Movie A to see what is happening. Be sure they observe the four groups of 2 in the first scene and the group of 8 in the second scene.

2 Tell them to look at the pictures for the answers as they read these four lines.

3 Explain that these are different ways of saying what happens in Movie A. Introduce the words *multiply* and *times*. Then ask the pupils to read the statements, saying the missing numbers. Have them show with objects or explain orally in terms of Movie A what groups each of the expressions stands for.

4 Movie B and its story may be treated in the same way.

5 Have the children read Exercises A to C, saying the missing numbers. If they do not know the answers, refer them back to Movies A and B and page 18.

How many dolls are on the table? 2
Betty divided them into groups of 4 dolls.
Now she has ▪ groups of 4 dolls.

1

A

8 divided into groups of 4 makes ▪ groups.
8 divided into fours means 8 divided by 4.
8 divided by 4 = ▪
Divide 8 by 4.

3

How many tops are on the table?
Billy divided them into groups of 2 tops.
Now he has ▪ groups of 2 tops.

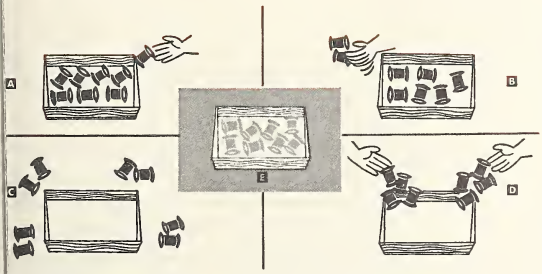
4

B

8 divided into groups of 2 makes ▪ groups.
8 divided into twos means 8 divided by 2.
8 divided by 2 = ▪
Divide 8 by 2.

5

A Divide 8 by 2.
B Divide 4 by 2.
C Divide 6 by 3.
D Divide 8 by 4.
E Divide 6 by 2.



A Don had 8 spools in a box. 1
He gave Billy 2 of the spools.
Then Don had ▪ spools in the box.

B Ellen had 8 spools in a box. 2
She put them in groups of 2 each.
Then she had ▪ groups of 2 spools.

C Carol put 2 groups of spools into a box.
There were 4 spools in each group.
Then she had ▪ spools in the box. 2

D Tom had 7 spools in a box. 2
He put 1 more spool in the box.
Then he had ▪ spools in the box.

A Multiply 4 by 2.
B Add 2 to 5. 3
C Divide 6 by 2.
D 8 minus 5 equals ▪.
E 4 times 2 = ▪
F 8 divided by 4 equals ▪.
G Subtract 2 from 8.
H 3 times 2 = ▪
I Divide 8 by 2.
J 4 plus 4 equals ▪.
K Add 1 to 7.
L Multiply 3 by 2.
M Divide 8 by 4.
N Subtract 6 from 8.
O Multiply 2 by 4.
P 8 minus 3 equals ▪.

4

On pages 21 to 25 you have learned how to add and multiply to make 8. You have also learned how to subtract from 8 and how to divide 8.

24

1 Have the children examine Movie A to see what happened. Be sure they observe the objects in the first scene as a group of 8 and in the second scene as 2 groups of 4. Stress the idea that the group of 8 was separated into 2 groups of 4.

2 Have them read these three lines. Tell them to look at the pictures for the answers.

3 Explain that these statements are different ways of saying what happened in Movie A. Introduce the word *divide*. Then ask the pupils to read the statements, saying the missing numbers. Have them show with objects or explain orally in terms of Movie A what each of the expressions stands for.

4 Movie B and its story may be handled in the same way.

5 Exercises A to E may be done orally. Some of the children may need to use objects to find the answers. Refer back to Movies A, B, and C and page 19.

25

1 Have pupils read this story orally, and find the pair of pictures at the top of the page that illustrates it. Picture E shows the 8 spools, and Picture B shows the action and gives the answer.

2 Use the same procedures for this story. Story B uses Pictures E and C. Story C uses Pictures D and E. Story D uses Pictures A and E. These stories can be dramatized by using objects.

3 The children may take turns reading Exercises A to P aloud. If a child cannot give answers immediately to exercises of the type A, B, and C, help him to think out the equation form for each and to work from there. He may also use objects. If you wish, have everyone write the equations and answers for all the exercises.

4 The concluding statement should always provide an opportunity to discuss what has been learned and to review. Children will enjoy this charting of their progress.

26-29 Moving forward

Expanded Notes for this lesson are on pages 222-223.

Objectives

The child becomes acquainted with the addition, subtraction, multiplication, and division basic facts for the 9 group (the basic facts whose sums, minuends, products, and dividends are 9).

Vocabulary

New words page 26 whistles, airplanes; page 27 horns*, bells*, banks*; page 29 him*, was*, bought*, shelf

Old words page 26 boats*, cars*; page 29 little*, store*

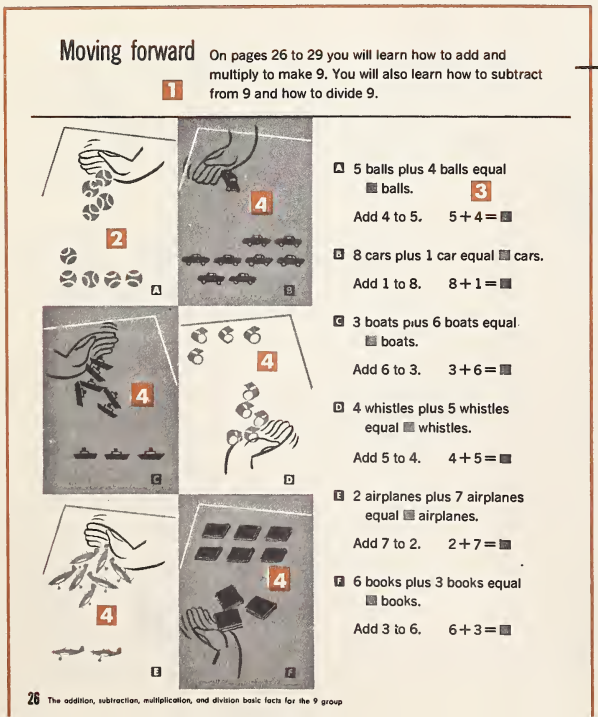
Comments

The block of work on the 9 group follows much the same pattern as that for the 8 group in the pages preceding.

On page 26 some of the addition basic facts for the 9 group are presented with pictures and symbols. Page 27 introduces some of the subtraction basic facts in the same way. Page 28 presents the multiplication and division basic facts and introduces the signs for "times" and "divided by." Page 29 introduces the remaining addition and subtraction facts and provides practice with abstract expressions used with the 6, 7, 8, and 9 groups.

Present the two new signs ($\times$, $\div$) with care. Be sure the children know that the times sign may be read in two ways. "$2 \times 4 = 8$" can be read as "2 times 4 equals 8" or as "4 multiplied by 2 equals 8." They should know that the number at the left of the sign represents the number of groups.

There is no single word for the division sign corresponding to *times* for the multiplication sign. It should be read "divided by." Expressions like "into" and "goes into" have been avoided in the text because they do not contribute to understanding of division. Children should know that the number at the left represents the whole or undivided group and the number at the right represents the size of the equal groups. The number at the right of the equals sign is the number of equal groups. This is true even in situations involving an unknown equal group. See pages 134-138 of *Book 3*.


Moving forward
1
On pages 26 to 29 you will learn how to add and multiply to make 9. You will also learn how to subtract from 9 and how to divide 9.
A 5 balls plus 4 balls equal ■ balls. 3
Add 4 to 5. 5+4=■
B 8 cars plus 1 car equal ■ cars.
Add 1 to 8. 8+1=■
C 3 boats plus 6 boats equal ■ boats.
Add 6 to 3. 3+6=■
D 4 whistles plus 5 whistles equal ■ whistles.
Add 5 to 4. 4+5=■
E 2 airplanes plus 7 airplanes equal ■ airplanes.
Add 7 to 2. 2+7=■
F 6 books plus 3 books equal ■ books.
Add 3 to 6. 6+3=■
26 The addition, subtraction, multiplication, and division basic facts for the 9 group

26

1 Have the children read the "Moving forward" section to find out what new things they are going to learn.

2 Direct the children to look at the picture. Ask questions that will help them determine how many balls are in each group and what action is taking place. The children may use markers or objects in the room to show the same groupings, to complete the action, and to find out how many objects there will be in all.

3 Have the children supply the missing numbers as they read the text. They should refer to the picture as they read and get the missing numbers from it.

4 Use the same procedures with this picture and its accompanying text.

A 9 horns minus 4 horns equal ■ horns.

Subtract 4 from 9.
9 − 4 = ■

B 9 bells minus 8 bells equal ■ bell.

Subtract 8 from 9.
9 − 8 = ■

C 9 cars minus 6 cars equal ■ cars.

Subtract 6 from 9.
9 − 6 = ■

D 9 whistles minus 2 whistles equal ■ whistles.

Subtract 2 from 9.
9 − 2 = ■

E 9 banks minus 5 banks equal ■ banks.

Subtract 5 from 9.
9 − 5 = ■

F 9 balls minus 7 balls equal ■ balls.

Subtract 7 from 9.
9 − 7 = ■

27

1 Direct the children to look at the picture. Ask questions that will help them determine how many objects there were at first, what is happening, how many objects are being removed, and how many will be left. You may then want to have the children use markers or objects in the room to show the whole grouping, to remove the group indicated, and to find how many are left.

2 Tell the children to put in the missing numbers as they read this story. Be sure they use the picture as they read.

3 Use the same procedures with this picture and its accompanying text.

How many groups of airplanes are on the table?
How many airplanes are in each group?
Billy put the airplanes into a box.
Now how many airplanes are in the box.

3 groups of 3 = ■ 3 threes = ■
3 multiplied by 3 = ■
3 times 3 = ■ 3 × 3 = 9

A 2 times 4 = ■ 2 × 4 = ■
B 3 times 2 = ■ 3 × 2 = ■
C 4 times 2 = ■ 4 × 2 = ■
D 2 times 2 = ■ 2 × 2 = ■
E 2 times 3 = ■ 2 × 3 = ■
F 3 times 3 = ■ 3 × 3 = ■

How many cars are in the box?
Tom divided them into groups of 3 cars.
Now he has ■ groups of 3 cars.

9 divided into groups of 3 makes ■ groups.
9 divided by 3 = ■ 9 ÷ 3 = 3

A 6 divided by 3 = ■ 6 ÷ 3 = ■
B 8 divided by 2 = ■ 8 ÷ 2 = ■
C 4 divided by 2 = ■ 4 ÷ 2 = ■
D 8 divided by 4 = ■ 8 ÷ 4 = ■
E 9 divided by 3 = ■ 9 ÷ 3 = ■
F 6 divided by 2 = ■ 6 ÷ 2 = ■

28

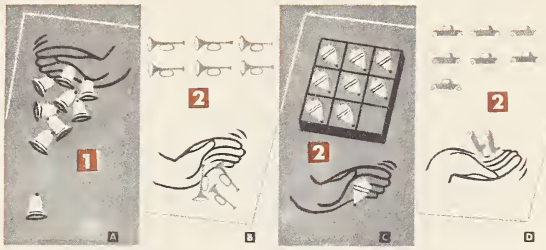
1 Have the children examine Movie A to see what happened. Be sure they observe the three groups of 3, then the group of 9.

2 Tell them to look at the pictures for the answers as they read these four lines.

3 Explain that the statements in these three lines are different ways of telling what happened in Movie A. Introduce the *times sign* before the children read these statements.

4 Have the children take turns reading Exercises A to F orally. Point out that the two equations in each exercise are read in the same way. Then the children may write these exercises, using the *times* sign and supplying the answers.

5 The same procedures may be adapted to the division pictures, text, and exercises. Get the children to observe the group of 9, then the three groups of 3, and to discuss what happened. Be sure to introduce the *division sign* before it is used in the text.



A There was 1 bell on the shelf.
Betty put 8 more bells on the shelf.
Then there were ▩ bells on the shelf.

B There were 9 horns in a store.
Nancy bought 3 of the horns.
Then there were ▩ horns in the store.

C Tom had 9 tops in a box.
He gave Billy 1 of the tops.
Then there were ▩ tops in the box.

D Don had 7 little cars.
Jack gave him 2 more cars.
Then Don had ▩ cars.

3
A 9+3=▩
B 2+7=▩
C Add 6 to 2.
D 9 minus 6=▩
E 3×3=▩
F Subtract 1 from 9.
G 7+2=▩
H 9 minus 5 equals ▩.
I Add 4 to 3.
J Multiply 4 by 2.
K Subtract 4 from 9.
L 3 plus 6 equals ▩.
M 9−3=▩
N 2 times 3=▩
O Add 5 to 4.
P 9−2=▩
Q 6 plus 3 equals ▩.
R Divide 8 by 4.

4 Now you have learned how to add and multiply to make 9. You have also learned how to subtract from 9 and how to divide 9.

29

29

1 Ask questions about Picture A that will help children see the action that is taking place and the result. Have them read Problem A. Then help them state the situation as the basic fact 1+8=9.

2 Handle this picture and its story in the same way.

3 Have the children take turns reading Exercises A to R aloud. If any of the children cannot give answers immediately to exercises of the type C, F, I, J, etc., help them think out the equation form for each and work from there. If necessary, let them use markers or objects. Then you may wish to have everyone write the equations and answers for the entire exercise.

4 Have the children read this statement. You may give them opportunities to prove that they know how to add, multiply, subtract, and divide with the 9 group by working with objects and telling in their own words what they are doing.

30-34 Moving forward

Expanded Notes for this lesson are on pages 223-225.

Objectives

The child becomes acquainted with the addition, subtraction, multiplication, and division basic facts for the 10 group (the basic facts whose sums, minuends, products, and dividends are 10).

Vocabulary

New words page 30 spoons, forks; page 32 mother*, tray; page 33 plate, June, did*

Old words page 30 apples*, bags*; page 31 cookies*, oranges; page 32 five*; page 33 big*

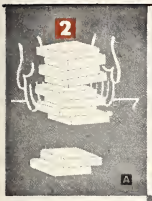
Comments

The block of work on the 10 group follows much the same pattern as that for the 8 and 9 groups. Page 32, however, introduces the computational form for multiplication, and page 33 introduces the computational form for division.

Actually, the computational form of the basic facts is never needed, since no processing of numbers is involved. The only activity required is that of recalling the answer. The form is introduced along with the basic facts, however, because tests and most sources of practice use it. The meaningful form of the basic fact is the equation. The computational forms for the four processes will become important later when the child learns to compute. You can require the children to rewrite equations in computational form from time to time.

Moving forward

1 On pages 30 to 34 you will learn how to add and multiply to make 10. You will also learn how to subtract from 10 and how to divide 10.

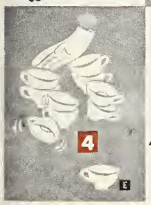


A 2 boxes plus 8 boxes equal ■ boxes. 3
Add 8 to 2. 2 + 8 = ■ 5

B 5 bags plus 5 bags equal ■ bags.
Add 5 to 5. 5 + 5 = ■

C 4 apples plus 6 apples equal ■ apples.
Add 6 to 4. 4 + 6 = ■

D 7 spoons plus 3 spoons equal ■ spoons.
Add 3 to 7. 7 + 3 = ■



E 1 cup plus 9 cups equals ■ cups.
Add 9 to 1. 1 + 9 = ■

F 6 forks plus 4 forks equal ■ forks.
Add 4 to 6. 6 + 4 = ■

A 10 spoons minus 2 spoons equal ■ spoons. 2
Subtract 2 from 10.
10 − 2 = ■ 4

B 10 cups minus 5 cups equal ■ cups.
Subtract 5 from 10.
10 − 5 = ■

C 10 cookies minus 9 cookies equal ■ cooky.
Subtract 9 from 10.
10 − 9 = ■

D 10 forks minus 3 forks equal ■ forks.
Subtract 3 from 10.
10 − 3 = ■

E 10 oranges minus 6 oranges equal ■ oranges.
Subtract 6 from 10.
10 − 6 = ■

F 10 apples minus 7 apples equal ■ apples.
Subtract 7 from 10.
10 − 7 = ■

30

1 Have the children read the "Moving forward" section to find out what new things they are going to learn.

2 Direct the children to look at Picture A. Ask questions that will help them determine how many objects there are in each group and what action is taking place. Then ask them to use markers or objects to show the same groupings, to complete the action, and to find out how many objects there will be altogether.

3 Have the children supply the missing numbers as they read this story. They should refer to the picture as they read and get the missing numbers from it.

4 Use the same procedures with this picture and its accompanying text.

5 Ask pupils to take turns reading the equations with answers. These equations are at the end of the text for each picture.

31

1 Have the children look at Picture A. Ask questions that will help them determine how many spoons were on the table at first and how many are falling off. Get them to use markers or objects to illustrate what is happening. Stress the separating action and the remaining group.

2 Tell the children to put in the missing numbers as they read Problem A. Insist on their referring to the picture.

3 Use the procedures suggested in Notes 1 and 2 above for this picture and its accompanying text.

4 Ask pupils to take turns reading the equations with answers. There is one equation at the end of the text for each picture.

How many groups of cups are on the table?
How many cups are in each group?
Betty put the cups on a tray. 2
How many cups are on the tray?

5 groups of 2 = ▢
5 twos = ▢ 2 multiplied by 5 = ▢ 3
5 times 2 = ▢ 5 × 2 = ▢
Multiply 2 by 5.

Multiply

$$\begin{array}{r} 2 \\ 5 \\ \hline \square \end{array}$$ 5

A

4

$$\begin{array}{r} 2 \\ 5 \\ \hline 10 \end{array}$$

5 × 2 = 10

How many groups of cups are on the table?
How many cups are in each group?
Mother put the cups on a tray.
Now how many cups are on the tray?

2 groups of 5 = ▢
2 fives = ▢ 5 multiplied by 2 = ▢
2 times 5 = ▢ 2 × 5 = ▢
Multiply 5 by 2.

Multiply

$$\begin{array}{r} 5 \\ 2 \\ \hline \square \end{array}$$

6

B

Multiply 7

A	B	C	D	E	F	G
2	3	5	4	3	2	2
3	3	2	2	2	2	4
▢	▢	▢	▢	▢	▢	▢

$$\begin{array}{r} 5 \\ 2 \\ \hline \square \end{array}$$

2 × 5 = ▢

32

1 Have the children examine Movie A to find out what happened. They should observe the 5 groups of 2 and then the group of 10. Discuss the action that made the change.

2 Let them refer to Movie A for answers.

3 As the children read these expressions with the answers, they should use the pictures. Then draw attention to the equation 5 × 2 = ▢ and ask them to find it in Movie A.

4 Now direct their attention to the computational form in Movie A. Show pupils how to read it from the top down as "2 multiplied by 5 is 10."

5 Let children read this example. Explain that the word *multiply* is used so that they will know that it is not an addition example.

6 Movie B and its text may be taught in the same way.

7 Exercises A to G may be read orally. You may also ask the class to write out the entire exercise, or, if you prefer, only the answers.

How many cookies did Carol put on the big plate?
She divided them into groups of 2 cookies. 2
Then she had ▢ groups of 2 cookies.

10 divided into groups of 2 makes ▢ groups.
10 divided by 2 = ▢
10 ÷ 2 = ▢ 3
Divide 10 by 2.

$$2\overline{)10}$$ 5

1

C

10 ÷ 2 = 5

$$2\overline{)10}$$ 4

How many cookies did June put on the big plate?
She divided them into groups of 5 cookies.
Then she had ▢ groups of 5 cookies.

10 divided into groups of 5 makes ▢ groups.
10 divided by 5 = ▢
10 ÷ 5 = ▢
Divide 10 by 5.

$$5\overline{)10}$$

6

D

10 ÷ 5 = ▢

$$5\overline{)10}$$

A	B	C	D
$2\overline{)6}$	$3\overline{)9}$	$2\overline{)8}$	$3\overline{)6}$

E	F	G	H
$4\overline{)8}$	$5\overline{)10}$	$2\overline{)4}$	$2\overline{)10}$

7

A 10 ÷ 5 = ▢
B 6 ÷ 2 = ▢
C 8 ÷ 4 = ▢
D 10 ÷ 2 = ▢
E 6 ÷ 3 = ▢
F 8 ÷ 2 = ▢

33

1 Have the children examine Movie C to see what happened. They should observe first the group of 10, then the 5 groups of 2.

2 Tell them to read these three lines, and to look at the pictures to find the answers.

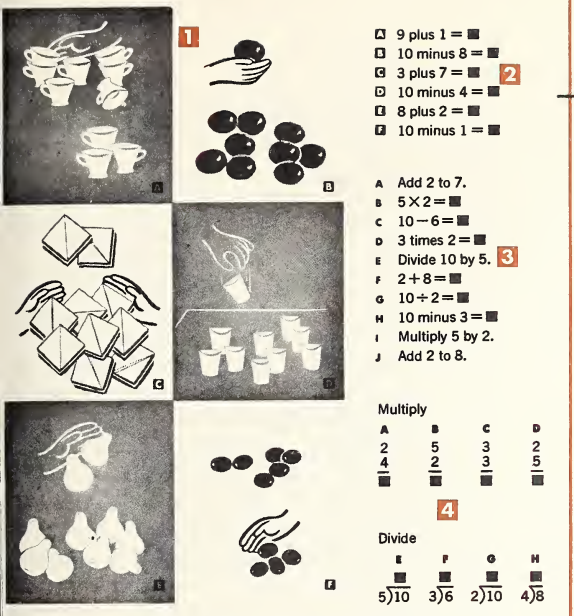
3 As the children read these expressions, they should use the pictures. Then draw attention to the equation 10 ÷ 2 = ▢ and ask them to find it in Movie C.

4 Now direct their attention to the computational form in Movie C. Tell pupils to read it "10 divided by 2 equals 5."

5 Let children read this example. Get them to observe that the word *divide* is not needed because of the arrangement of the numbers.

6 Movie D and its problem may be handled in the same way.

7 The children may write Exercises A to H and A to F. A to H may be written in equation form and A to F in computational form.


1
A 9 plus 1 = ■
B 10 minus 8 = ■
C 3 plus 7 = ■
D 10 minus 4 = ■
E 8 plus 2 = ■
F 10 minus 1 = ■
2
A Add 2 to 7.
B 5 × 2 = ■
C 10 − 6 = ■
D 3 times 2 = ■
E Divide 10 by 5.
F 2 + 8 = ■
G 10 ÷ 2 = ■
H 10 minus 3 = ■
I Multiply 5 by 2.
J Add 2 to 8.
3
Multiply
A B C D
2 5 3 2
4 2 3 5
■ ■ ■ ■
4
Divide
E F G H
■ ■ ■ ■
5)10 3)6 2)10 4)8
Now you should know how to add and multiply to make 10. You should also know how to subtract from 10 and how to divide 10.
34

34

1 Have the children look over Pictures A to F and decide which ones make them think of adding and which ones make them think of subtracting. Ask them to tell the story of each picture, finishing it by turning each story into an equation.

2 Ask the children to match each of the statements A to F with its corresponding picture.

3 For Exercises A to J let the children take turns giving the answers orally. Then you may ask all the children to write the exercises with answers. If any of the pupils cannot give immediate answers to A, E, I, or J, help them to think out the equation form. These exercises may also be written in computational form if you wish.

4 Exercises A to H may be written with the answers. You may suggest that they be written in equation form as an additional activity.

35 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices the addition, subtraction, multiplication, and division basic facts for all groups through 10.

Vocabulary

No new words are introduced.

Comments

As has been explained before, the purpose of the pages entitled "Keeping skillful" is twofold: to give the child practice that will help him retain previously taught skills and concepts, and to provide the teacher with a means of determining what reteaching should be done before proceeding further.

The picture provides a means of determining how well the child understands the actions of combining and separating groups. This understanding is basic to a knowledge of the processes.

The exercises at the right of the picture give a means of diagnosing general weakness in any of the processes.

The exercises (A to R) at the bottom of the page reveal how well the child can shift from one process to another and how well he understands the terminology of the basic facts.

The test that follows on page 36 will be more detailed in revealing specific weaknesses.

35

1 Have the children look at the picture of the animals. Ask them to note the kind of action taking place in each group and to describe it. Then direct them to state each action and its result with numerals and signs or the words for them. Encourage the children to use the words *plus, minus, multiplied by,* and *times.* Abler students may restate these expressions using *add, subtract,* and *multiply.* Have the children try to see who can be the first to find an example, anywhere on the page, that tells what is happening to each group.

2 The children may copy the examples as they appear in the text and write the answers in place of the screens, or they may write only the identifying letters and the answers. If you prefer, have them take turns answering the examples orally or restating them as equations.

3 The procedures for the preceding exercises may be used for Examples A to R.

36 Checking up

Expanded Notes for this lesson are on page 225.

Objectives

The child is provided with a complete test on all the basic facts through the 10 group (the basic facts whose sums, minuends, products, and dividends are 10 or less).

Vocabulary

New words page 36 test

Comments

Since this is not a speed test, you should give the children ample time to complete their work.

You should expect the average and better-than-average students to complete all equations correctly. The slower children will show need of some reteaching activities.

Use as many of the eight tests during one class period as you feel is advisable for your particular group of children. Ask them to copy the labeling letter for each basic fact and write the answer on their papers. If you prefer, the children may write the entire equation form, including the answer.

The tests are arranged so that you can easily locate the area of difficulty for each child. Time should be devoted to reteaching before proceeding further. One of the greatest sources of failure in arithmetic is inadequate knowledge of basic facts.

The lessons preceding this test should be used for reteaching. It is a good plan to organize the children into groups for this reteaching. Children who know their basic facts should be excused from the review. Let them work on other subject matter or let them read a good book.

Checking up

Test 1 1

A 5+2=■
B 3+3=■
C 1+4=■
D 2+1=■
E 2+4=■
F 3+1=■
G 1+1=■
H 3+4=■
I 6+1=■
J 5+1=■
K 3+2=■
L 2+2=■
M 1+6=■
N 4+1=■
O 2+5=■
P 4+2=■
Q 1+3=■
R 2+3=■
S 1+5=■
T 4+3=■
U 1+2=■

Test 2 2

A 5+3=■
B 8+2=■
C 4+4=■
D 3+6=■
E 7+1=■
F 5+5=■
G 9+1=■
H 2+6=■

Test 3 3

A 7−2=■
B 3−2=■
C 6−1=■
D 5−3=■
E 7−5=■
F 4−2=■
G 6−4=■
H 7−3=■
I 7−6=■
J 4−3=■
K 5−2=■
L 3−1=■
M 6−2=■
N 5−4=■
O 6−3=■
P 7−1=■
Q 6−5=■
R 5−1=■
S 7−4=■
T 4−1=■

Test 4 4

A 10−4=■
B 8−5=■
C 9−2=■
D 10−1=■
E 9−8=■
F 8−6=■
G 9−3=■
H 8−7=■
I 9−5=■
J 8−4=■
K 10−6=■
L 9−1=■
M 8−3=■
N 10−2=■
O 9−7=■
P 10−5=■
Q 9−6=■
R 10−8=■
S 8−2=■
T 10−3=■
U 9−4=■
V 10−7=■
W 8−1=■
X 10−9=■

Test 5 5

A 2×4=■
B 3×3=■
C 3×2=■
D 2×2=■
E 5×2=■
F 2×3=■
G 4×2=■
H 2×5=■
I 3×3=■

Test 6 6

A 8÷4=■
B 6÷2=■
C 9÷3=■
D 10÷5=■
E 4÷2=■
F 8÷2=■
G 10÷2=■
H 6÷3=■
I 8÷4=■
J 9÷3=■

Test 7 7

A 4+6=■
B 6+3=■
C 9−7=■
D 4×2=■
E 10÷2=■
F 7−5=■
G 5+4=■
H 3+7=■
I 8÷4=■
J 10−7=■
K 3+6=■
L 9÷3=■
M 8−5=■
N 2×3=■
O 2−1=■
P 5+5=■
Q 2×5=■
R 7+2=■
S 2×2=■

Test 8 7

A 4÷2=■
B 10−6=■
C 9−4=■
D 3×3=■
E 2+4=■
F 7−2=■
G 5×2=■
H 6−2=■
I 3+5=■
J 10÷5=■
K 8÷2=■
L 4+3=■
M 2+8=■
N 6÷2=■
O 2+5=■
P 4+4=■
Q 3×2=■
R 5−3=■
S 2×4=■

sts on all the addition, subtraction, multiplication, and division basic facts through the 10 group

36

1 Test on the addition basic facts for the 2, 3, 4, 5, 6, and 7 groups (taught on pages 3-6, 14, and 16)

2 Test on the addition basic facts for the 8, 9, and 10 groups (taught on pages 21, 26, and 30)

3 Test on the subtraction basic facts for the 2, 3, 4, 5, 6, and 7 groups (taught on pages 8-12 and 15)

4 Test on the subtraction basic facts for the 8, 9, and 10 groups (taught on pages 22, 27, and 31)

5 Test on the multiplication basic facts for the 4, 6, 8, 9, and 10 groups (taught on pages 17-18, 23, 28, and 32)

6 Test on the division basic facts for the 4, 6, 8, 9, and 10 groups (taught on pages 19-20, 24, 28, and 33)

7 Test on mixed addition subtraction, multiplication, and division basic facts

37-41 Exploring problems

ponded Notes for this lesson are on pages 225-228.

bjectives

ne child begins to learn the techniques of problem lving. He learns to make an equation that tells what ppens in the situation.

cabulary

ntinue to use orally the word *equation*. It is needed to scribe the group of symbols that represent the problem. ew words page 37 barnyard*, ponies*; page 38 eping*; page 40 tree*; page 41 came*, what*, ite*, flew*, signs*, problem

d words page 38 pigs*, running*, ducks*; page 40 ckens*; page 41 all*, basket*, birds*, blocks, child, ldren*, cows*, house*, took*, toy*, turtles*, with*

nments

ildren learn to describe a problem situation by writ- an equation (such as 2+3=■) that stands for it.

In previous lessons they have met the four basic types of problem situations (additive, subtractive, multiplicative, and divisive). They have learned to note the action in each situation and have seen how the entire situation can be represented by symbols. Now they learn how to make equations for problems.

The lessons on making equations are fundamental, for, although they deal with the simple basic facts that children are already supposed to know, they lay a foundation for all future developmental work in problem solving.

One of the hardest things to teach the child is how to think about a problem before he computes. Too often his attention is focused on the computation only.

The equation, which the child will be required to make for every problem, is a written indication of the child's thinking. As such, it will be of service to you in appraising the child's learning.

These lessons, then, are only the first steps toward a systematic approach to problem solving. In this approach the child learns how to think about the problem situation, and how to show his thinking in simple written form. His choice of a computational process is not a matter of "hunch" or trial and error, but instead is based on reasoning about the situation. Later, lessons called "Using arithmetic" that use these problem solving techniques are introduced. With larger quantities involved, children will not only have to make equations, but also do actual computations to find answers.

Answers

Given here is the equation necessary for understanding and solving each problem. The bracketed number represents the screen in the equation and shows the answer to be obtained.

Page 38:

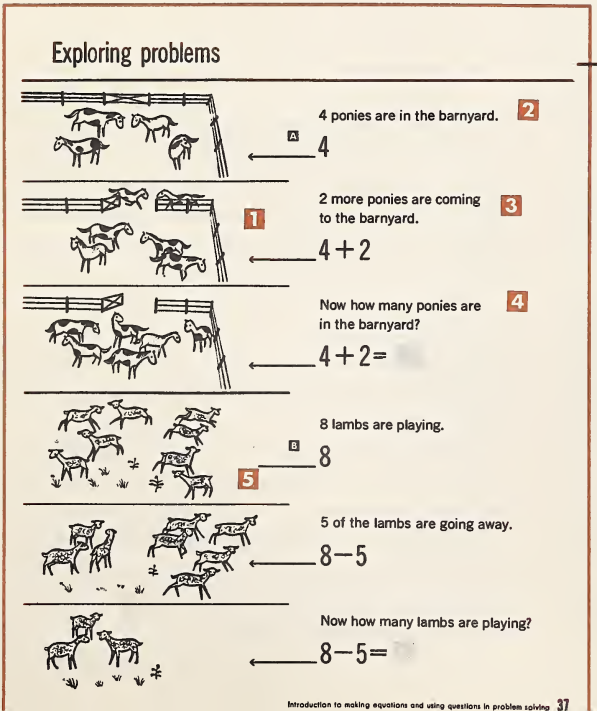
C 3+2=[5]
D 7−4=[3]
E 2+5=[7]
F 3+4=[7]
G 7−2=[5]
H 6−4=[2]

Page 40:

C 3×3=[9]
D 6÷2=[3]
E 2×3=[6]
F 4×2=[8]
G 9÷3=[3]

Page 41:

A 8÷4=[2]
B 1+5=[6]
C 6−4=[2]
D 4×2=[8]
E 2+2=[4]
F 4−2=[2]
G 2×5=[10]
H 6+4=[10]
I 8÷4=[2]
J 7−2=[5]
K 3×2=[6]
L 9−3=[6]
M 10÷5=[2]



37

1 Have the class look at Movie A.

2 Have someone read this sentence. Help th class to understand that the 4, written beneath stands for the number of ponies to which th arrow is pointing.

3 Direct the pupils to read this sentence. Ca attention to the picture at the left. Point ou that the "+2" has been put with the 4 beneat the sentence to show that 2 ponies are joinin the 4 ponies.

4 Ask the pupils to read this question, and hav them note what has been added below. Ex plain that we call all of this an equation, an that it uses numerals and signs to stand fo what we read or what we see in the picture Have the pupils look at the picture to chec the answer, which they should think or say i place of the screen.

5 Movie B and text may be handled in the sam way, with attention focused on the subtracti action.

C 3 squirrels are eating. 2
2 squirrels are running to eat.
Then ■ squirrels will be eating.
3 —— 2 = ■

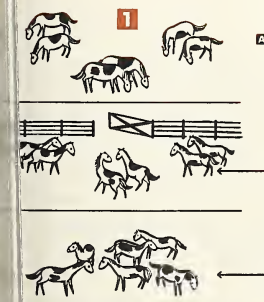
D 7 dogs were playing.
4 of the dogs are going away.
Now ■ dogs are playing.
7 —— ■ = ■

E 2 rabbits are eating.
5 rabbits are coming to eat.
Then ■ rabbits will be eating.
■ —— ■ = ■

F 3 ducks are in the pond.
4 ducks are coming to the pond
Then ■ ducks will be in the pon
■ —— ■ = ■

G 7 kittens were sleeping.
2 of the kittens are going away.
Now ■ kittens are sleeping.
■ —— ■ = ■

H 6 pigs were eating
4 of the pigs are going away.
Now ■ pigs are eating.
—— ■ = ■



A 3 groups of ponies are eating. 2
There are 2 ponies in each group.

The 3 groups of 2 ponies are going to the barnyard. 3

3×2

How many ponies are in the barnyard now? 4

3×2=

B 8 lambs are playing.

8

Now they are going away in groups of 2.

8÷2

There are how many groups of 2?

8÷2=

38

1 Have the children tell what is happening. Let them decide whether the picture makes them think of adding or subtracting.

2 As each line is read, have the children put their fingers on the groups involved in the picture. Explain that the wavy line in the equation below indicates that a plus sign or minus sign is missing and that what is happening in the picture tells which it is. Have the children use the picture to help them read the complete statement.

3 This picture and its text may be handled in the same way as Picture C. After the six problems on this page have been done orally, have the pupils write the equation for each problem.

39

1 Have the class look at the first picture in this movie to find out how many groups of ponies there are and how many ponies there are in each group.

2 Have the children read these statements and compare them with the picture to see if they are right.

3 Have them read this sentence. Help them to understand that the "3×2," written beneath, is the beginning of an equation that stands for the 3 groups of 2 ponies coming together at the gate. Tell the pupils to look at the picture to which the arrow is pointing.

4 Have the children read this question. Ask what has been added to the equation. Tell them to look where the arrow is pointing to find the number that the screen is covering.

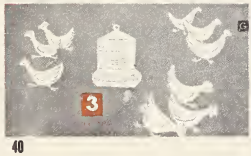
5 Handle Movie B and text in the same way, with attention focused on the divisive action.

3 groups of rabbits are going to eat.
3 rabbits are in each group.
Then ■ rabbits will be eating.
3 ~~ 3 = ■

D 6 ducks were in the pond.
Now they are going away in groups of 2.
There are ■ groups of 2 ducks.
6 ~~ ■ = ■

2 groups of kittens are going to play.
3 kittens are in each group.
Then ■ kittens will be playing.
■ ~~ ■ = ■

F 4 groups of squirrels are running to the tree.
2 squirrels are in each group.
Then ■ squirrels will be in the tree.
■ ~~ ■ = ■



9 chickens were eating.
Now they are going away in groups of 3.
There are ■ groups of 3 chickens.
■ ~~ ■ = ■

40

40

1 Have the children look at Picture C. Let them decide whether what is happening with the groups makes them think of adding, subtracting, multiplying, or dividing, and tell why.

2 Call on one child to read these three statements and say the missing number. Remind the children that the wavy line in the equation indicates that a sign is missing. Tell them that what is happening in the picture shows what this sign should be. Be sure the children know what each number in the equation stands for in the picture.

3 Proceed in the same way for this picture and its accompanying text. Then you may have the pupils write the equation for each problem without referring to the one in the text.

41

1 Let one child read this problem. Then ask the children questions about it that will help them determine the numbers of objects in the groups, what happens, and, from this action, the type of problem situation (adding, subtracting, multiplying, or dividing). Then direct attention to the equation with the wavy line for the missing sign. Let them decide what sign to use and give reasons for their choice.

2 Note that there is no equation given. Let a child read the problem. Then assist the children in making the equation, using a screen for the unknown number. The equation should be written on the board. Require them to tell what each number stands for and to justify the selection of the sign. Finally rewrite the equation with the answer.

3 Have the children write the letters F to M in a column on paper. Then direct them to reread the problems and write the equation for each one.

A Jack had 8 blocks. 1
He separated them into groups of 4 blocks.
Then he had how many groups of blocks?
8 ~~ 4 = ■

B 1 child was playing. 1
5 more children came to play.
How many children were playing then?
1 ~~ 5 = ■

C 6 dolls were in the dollhouse.
Nancy took 4 of the dolls from the dollhouse. 1
Then how many dolls were left in the dollhouse?
6 ~~ 4 = ■

D Billy put 4 groups of cars into a box.
There were 2 cars in each group. 1
How many cars were in the box?
4 ~~ 2 = ■

E 3 cows were in the barnyard.
2 more cows came into the barnyard.
Then how many cows were in the barnyard? 1
3 ~~ 2 = ■

F Betty painted 4 pictures. 2
She gave 2 pictures to Mother. 3
Betty had how many pictures left?

G Carol had 2 groups of toy kittens.
There were 5 kittens in each group.
She put all the kittens in a basket.
How many kittens were in the basket?

H 6 turtles were in a pond.
4 more turtles came into the pond.
Then there were how many turtles in the pond?

I 8 birds were on a tree.
They flew away in groups of 4.
How many groups of birds flew away?

J Tom had 7 toy boats.
He gave Don 2 of the boats.
Then Tom had how many boats?

K Nancy had 3 groups of toy cows.
There were 2 cows in each group.
She put them all in a barn.
How many cows did she put in the barn?

L 9 balls were on a shelf.
Carol took 3 balls from the shelf.
Then how many balls were on the shelf?

M 10 children were playing.
They separated into groups of 5.
There were how many groups of children?

From now on you can write with numbers and signs what a problem means.

42-45 Moving forward

Expanded Notes for this lesson are on pages 228-233.

Objectives

The child becomes acquainted with the rôle of ten in our number system. He learns the meaning of two-figure numbers and of place value.

Vocabulary

New words page 42 figures, numerals; page 43 twenty, thirty, forty, fifty; page 44 eleven, twelve

Old words page 43 sixty*, seventy, eighty, ninety, ten*; page 45 one*

Comments

One of the most important aims in arithmetic—and one often treated too lightly—is the development of an understanding of our number system. An understanding of the number system leads to much more than accurate reading and writing of large numbers. It paves the way for ease in adding, subtracting, multiplying, and dividing, particularly with the borrowing and carrying that may be involved in these processes.

In becoming acquainted with the number system in the lesson on pages 42-45, children first work with objects or pictures of objects grouped in tens and ones. This work provides a background for developing understanding of two-figure numbers. The children learn to represent the objects by tally marks and numerals. They soon learn that only ten symbols—the numerals 1 to 9 and 0—are necessary to write any number. At the same time they begin to see that the same tally mark or number symbol can stand for one or for ten and that it is the place in which it is put that shows what it stands for.

Page 43 introduces the decade numbers and teaches their meaning, names, and order. Page 44 introduces the "teen" numbers and teaches their meaning, names, and order. Page 45 pictures a few more two-place numbers and provides exercises testing the child's understanding of the number system through two places.

Answers

Page 42: Picture A, Box B, Numeral D; B, L, F; C, E, J; D, C, N; E, A, A; F, H, B; G, G, L; H, I, E; I, J, H

Moving forward
On pages 42 to 45 you will learn to read and write numerals with two figures in them.
A B C D E F G H I J K L M N
18 75 25 47 64 81 89 36 56 33 48 29 63 92

42

1. Ask pupils to look at Picture A. Point out the 7 single marbles and 4 bags of 10 marbles each.
2. Draw on the board a tally box similar to this. Tell the class you will make one tally mark on the left side of the center line for each bag of 10 marbles and one tally mark on the right side for each single marble in Picture A. Let them find this tally box in A to L.
3. Call on a pupil to tell the number of tally marks on the board that stand for the tens. Write the numeral beneath these tally marks. Have him count the tally marks for the ones. Write the numeral beneath these tally marks. Have pupils find this number in the list A to N.
4. Use the above procedures for this picture.
5. Pay particular attention to this picture and its tally marks (E) and numeral (J), for they clearly show that the same tally mark or numeral can stand for 1 or 10 and that the place where each is put shows which it stands for.

A ten twenty ⁓ forty fifty ⁓ seventy ⁓ ninety
B ⁓ thirty forty ⁓ ⁓ seventy eighty ⁓
C ten ⁓ thirty forty ⁓ sixty ⁓ ⁓ ninety
D forty ⁓ ⁓ seventy ⁓ ninety
E thirty forty ⁓ sixty ⁓ eighty ⁓
F twenty ⁓ ⁓ fifty ⁓ seventy eighty ⁓
G ⁓ ⁓ thirty forty ⁓ sixty ⁓ eighty ⁓

A fifty
F eighty
B seventy
G ten
C ninety
H sixty
D twenty
I thirty
E forty

43

A ten ⁓ twelve ⁓ fourteen ⁓ sixteen
B fourteen fifteen ⁓ seventeen ⁓ nineteen
C twelve ⁓ fourteen ⁓ sixteen seventeen ⁓ ⁓
D eleven ⁓ ⁓ fourteen ⁓ ⁓ seventeen eighteen ⁓
E thirteen fourteen ⁓ sixteen ⁓ ⁓ nineteen
F fifteen ⁓ ⁓ eighteen ⁓
G twelve thirteen ⁓ fifteen ⁓ seventeen ⁓ ⁓

A eighteen
F sixteen
B eleven
G fourteen
C twelve
H seventeen
D nineteen
I fifteen
E thirteen

43

1 Let pupils look at Picture A and determine that there are 10 jacks on the card. Get pupils to tell why the tally mark has been placed where it is and why there is an empty space on the right side. Then ask what the 1 in the numeral below the box means. Explain that the zero means that there are no ones—no single jacks. Explain that without the zero we would not be able to tell that the figure 1 meant one ten. Next have the children note how the word *ten* is written and have them pronounce it.

2 Continue in the same way for this picture.

3 Exercises A to G may be done orally first. Have the children take turns saying each sequence, including the missing number names. Then tell them to place the letters A to G on their papers and write the missing words.

4 Ask children to pronounce Exercises A to I aloud. Then have them write the numerals that correspond to the words. Finally, have them write the numerals in the order of quantity.

44

1 Ask questions about Picture A similar to these: "What is meant by the one tally mark on the left side of the tally box? By the one tally mark on the right side? What does the numeral 1 on the left mean? What does the 1 on the right mean?" Tell the children to read this number as "eleven" and point to the printed word.

2 Continue in the same way with this picture. Help the children to associate the name *teen* with one ten and to notice the similarity of the names of the numerals to the number of ones involved.

3 Exercises A to G provide practice on the sequence of the "teens." The children may do these orally first, then write the letters A to G and supply the missing number words.

4 Have pupils pronounce Exercises A to I aloud. Then have them write the numerals in place of the words. Finally, have them write the numerals in the correct order.

A 8 tens 4 ones = ■
B 1 ten 9 ones = ■
C 5 tens 7 ones = ■
D 3 tens 6 ones = ■
E 8 tens 9 ones = ■ 3
F 2 tens 2 ones = ■
G 6 tens 8 ones = ■
H 9 tens 5 ones = ■
I 4 tens 1 one = ■
J 7 tens 6 ones = ■
K 5 tens 3 ones = ■
L 1 ten 1 one = ■
M 6 tens 3 ones = ■
N 7 tens 2 ones = ■
O 9 tens 9 ones = ■

A thirty-one = 3 tens ■ one
B eighty-three = ■ tens 3 ones
C sixty-two = ■ tens ■ ones
D fifty-four = ■ tens ■ ones 4
E ninety-six = ■ tens ■ ones
F twenty-seven = ■ tens ■ ones
G seventy-nine = ■ tens ■ ones
H forty-eight = ■ tens ■ ones
I eighty-five = ■ tens ■ ones
J twenty-six = ■ tens ■ ones
K seventy-two = ■ tens ■ ones
L thirty-seven = ■ tens ■ ones
M sixty-eight = ■ tens ■ ones
N eighteen = ■ ten ■ ones
O fifty-two = ■ tens ■ ones

Now you should know how to read and write the numerals from 1 to 99.

45

45

1 Ask a pupil what the 3 in the tally box stands for. Ask another pupil what the 4 stands for. Tell the children to notice how the number is written below the tally box and also how it is written as a word.

2 Continue in the same way with this picture. Give additional experience with bundles of 10 objects and single objects (sticks, strips of cardboard, etc.), if necessary.

3 Have the children answer these exercises. Ask them for another name for the number of tens involved in each exercise (8 tens as *eighty* in Exercise A, for example). They should be able to tell the number of ones and give the name of the complete number. Then you may have them write the answers for the entire exercise, if you wish.

4 The children may take turns answering these exercises orally.

46-49 Moving forward

Expanded Notes for this lesson are on pages 233-235.

Objectives

The child uses the number system in learning to regroup ones and tens as preparation for carrying in addition and multiplication and for borrowing in subtraction. From many experiences he learns that data can be rearranged without changing values.

Vocabulary

New word page 49 understand

Comments

In the previous block of work children learned how objects grouped in tens and ones can be symbolized by tally marks or numerals whose position indicates the value. They learned the meaning of two-figure numbers in terms of how many tens and ones there were. In this new block of work they again meet objects grouped in tens and ones. On pages 46 and 47 the children will learn what to do when there are more than 9 ones. They must learn this before they can carry in computation.

Pages 48 and 49 provide activities that require children to change a group of ten into ones. This prepares them for borrowing in subtraction.

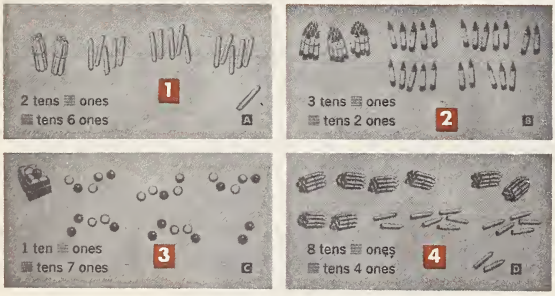
The work will be much more meaningful if objects are used. Bundles of sticks or boxes of stones can be used. Always work with the box or group of 10 towards the child's left and the single objects towards his right. The child must learn that position indicates value.

Answers

Answers are not provided because they are obvious upon inspection.

Moving forward

On pages 46 to 49 you will learn more about numerals with two figures and what they mean.



A 8 tens 12 ones
9 tens ones

B 5 tens 14 ones
tens ones

C 7 tens 15 ones
tens ones

D 4 tens 12 ones
tens ones

E 7 tens 24 ones
tens ones

F 1 ten 26 ones
tens ones

G 6 tens 17 ones
tens ones

H 4 tens 14 ones
tens ones

I 2 tens 29 ones
tens ones

J 5 tens 16 ones
tens ones

K 1 ten 38 ones
tens ones

L 1 ten 13 ones
tens ones

M 2 tens 25 ones
tens ones

N 8 tens 16 ones
tens ones

O 3 tens 33 ones
tens ones

P 1 ten 19 ones
tens ones

Q 3 tens 27 ones
tens ones

R 8 tens 14 ones
tens ones

S 4 tens 35 ones
tens ones

T 6 tens 19 ones
tens ones

U 2 tens 12 ones
tens ones

V 5 tens 35 ones
tens ones

W 7 tens 18 ones
tens ones

X 2 tens 32 ones
tens ones

46

1 Have the children look at the first scene of Movie A. Point out that there are 10 crayons in each bundle. Ask how many bundles of ten there are and how many extra ones. Tell them to check to see that the figures have been put in the correct places in the white box. Let the children discover that the name of the number cannot be given until something is done with the 12 single crayons.

2 Call attention to the second scene. Help the children see that ten of the single crayons have been bundled together to make another group of ten.

3 Ask the children what has happened. Ask: "How many bundles of ten crayons are there now? How many single crayons? Have the new figures been put in the right places in the white box? Can you read this numeral?"

4 Proceed in the same way for this movie. Be sure to point out that the picture that shows the bundling of the ten ones is omitted.

47

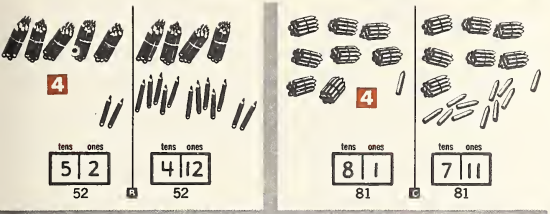
1 Have the children look at Picture A to see how many bundles of 10 paste sticks there are and how many single sticks. Then ask someone to give the missing numbers in the text.

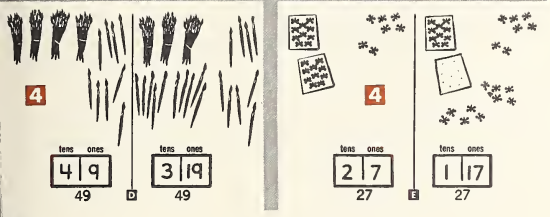
2 If possible, duplicate Picture B with crayons or other objects. Ask if there are enough single crayons to make more than one group of ten. Call on a pupil to put the single objects into bundles of ten and have him put the 2 bundles with the original 3 bundles. Have him read the two lines of text with answers.

3 After children have determined how many ones there are, ask questions such as these: "Are there 27 single marbles? You have learned that 27 is how many tens and how many ones? What should you do with the 2 tens? How many tens in all are there then? How many ones are left?"

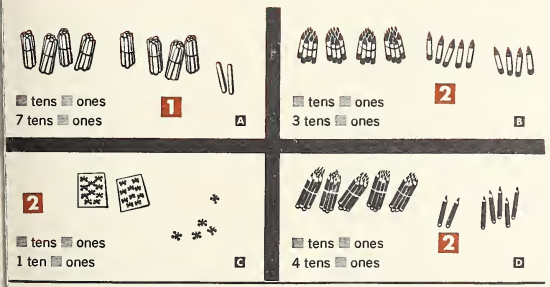
4 Movie D should be treated in the same way.

5 Exercises A to X should be done orally first. Then let the children write the answers.





48



3

A 34 = 3 tens ones
2 tens ones

B 65 = tens 5 ones
tens 15 ones

C 46 = tens ones
tens ones

D 33 = tens ones
tens ones

E 28 = tens ones
ten ones

F 49 = tens ones
tens ones

G 24 = tens ones
ten ones

4

A 67 = 5 tens ones
B 39 = tens ones
C 88 = tens ones
D 57 = tens ones
E 96 = tens ones
F 53 = tens ones
G 64 = tens ones
H 75 = tens ones
I 92 = tens ones
J 85 = tens ones
K 77 = tens ones
L 23 = ten ones
M 59 = tens ones
N 72 = tens ones
O 99 = tens ones
P 42 = tens ones
Q 84 = tens ones

Now you should understand the meaning of numerals that have two figures in them.

49

48

1 Have the children look at the first scene of Movie A. Tell them that there are 10 crayons in each bundle. Ask how many bundles of ten there are and how many extra ones. Then ask if the correct numerals have been put in the white box.

2 Call attention to the second scene of Movie A. Help the children see that one of the bundles of ten crayons is being put with the single crayons. If objects are available, dramatize this.

3 Ask the children what has happened in the third scene. Ask: "Has the bundle of 10 crayons been broken up into 10 single crayons? How many single crayons are there in all now? Have the correct numerals been put in the right places? Are 2 tens 18 ones the same as 38?"

4 Continue in the same way with the remaining movies. Explain that the middle picture showing the regrouping has been omitted. If objects are available, let the children dramatize the missing action.

49

1 Have the children look at Picture A to see how many bundles of 10 paste sticks there are and how many extra sticks. Ask someone to read the two lines of text, saying the missing numbers.

2 Proceed in the same way with this picture.

3 For Exercises A to G direct the children to determine first how many tens and how many ones there are in the number as printed. Then direct them to think of one of the tens as ten ones and to put these ten ones with the ones stated in the number. From their previous work with the number system they should know that when a ten is put with ones in a situation like this the resulting number is a "teen" number. The exercises may be done orally. The exercises can be also done in writing.

4 Exercises A to Q may be done orally, and (with caution) in writing. Tell them to change one of the tens into 10 ones in each exercise.

50-51 Using arithmetic

Expanded Notes for this lesson are on page 235.

Objectives

The child practices making equations to solve problems that are in the verbal question form. He reviews the number system and some of the basic facts.

Vocabulary

New words page 50 it*, ate*, look*; page 51 his*, her*, firemen*, policemen*

Old words page 50 at*, pennies*

Comments

Children need help in learning how to think about the conventional verbal problem. They have to learn to visualize the problem situation to "see" the action that takes place. Then they need to learn to make an equation that represents the situation described.

On pages 37-41 children were introduced to the making of equations as a basic step in solving problems. Pages 50 and 51 provide additional practice in solving simple problems. As in the previous lesson, these problems involve only basic facts. Therefore, children can answer the problems without actually making equations. Encourage the children to make equations, however, so that they can show their thinking to others and also develop proper habits of response for solving more difficult problems later.

For Problems A to H, the equations have been printed with wavy lines in place of the signs. As in previous lessons with partially made equations, the children are to supply the signs that stand for the actions. Some of the children will profit from the use of objects to set up and work out the problems.

Notice that the verbal problem is being slowly evolved. Each statement and the question continues to be given separately, that is, started on a separate line.

A "Keeping skillful," providing practice on the number system and some of the basic facts, appears at the bottom of page 51. These exercises should be handled separately from the problem set.

Answers

Using arithmetic:

Given here is the equation necessary for understanding and solving each problem. The bracketed number represents the screen in the equation and shows the answer to be obtained.

A $6-3=[3]$	F $9\div3=[3]$	K $3+3=[6]$
B $3+2=[5]$	G $7-2=[5]$	L $6\div3=[2]$
C $10\div5=[2]$	H $7+3=[10]$	M $7+2=[9]$
D $4\times2=[8]$	I $3\times2=[6]$	N $4\times2=[8]$
E $8-6=[2]$	J $10-4=[6]$	

Keeping skillful:

The answers are obvious. In Exercises A to P, the child reduces the tens by one and increases the ones by ten. In Exercises A to H, he changes the ones to as many tens as possible and increases the tens accordingly.

Using arithmetic

A

B

A Look at Picture A.
How many children are left at the table? **1**
6 ⌒ 3 = ☐

B Look at Picture B.
How many children will there be at the table? **2**
3 ⌒ 2 = ☐

C Bill put 10 balls into groups.
He put 5 balls in each group. **3**
How many groups did he make?
10 ⌒ 5 = ☐

D Ellen put 4 groups of horns on the shelf.
There were 2 horns in each group.
How many horns were on the shelf then? **3**
4 ⌒ 2 = ☐

E 8 cookies were on a plate.
The children ate 6 of them. **3**
How many cookies were left?
8 ⌒ 6 = ☐

F Ellen put 9 spools into groups.
She put 3 spools in each group. **3**
How many groups did she make?
9 ⌒ 3 = ☐

G Carol had 7 pictures. **3**
She gave 2 of them to Ellen.
Carol had how many pictures then?
7 ⌒ 2 = ☐

H Don had 7 pennies in a bank. **3**
Mother gave him 3 more pennies to put in it.
Then Don had how many pennies in the bank?
7 ⌒ 3 = ☐

I Jack put 3 groups of whistles on the table.
There were 2 whistles **1**
in each group.
Then how many whistles were on the table?

J Tom had 10 toy firemen.
He gave 4 of his toy firemen to Don.
Then Tom had how many firemen?

K Bill had 3 toy policemen.
Don gave him 3 more policemen.
Then Bill had how many policemen?

L Ellen put 6 cookies into groups.
She put 3 cookies in each group.
How many groups did she make?

M Carol had 7 spoons.
Ellen gave her 2 more spoons.
How many spoons did Carol have then?

N June put 4 groups of oranges on the table.
There were 2 oranges in each group.
Then how many oranges were on the table?

2 Keeping skillful

A 44 = 3 tens ☐ ones
B 29 = ☐ ten ☐ ones
C 56 = ☐ tens ☐ ones
D 97 = ☐ tens ☐ ones
E 31 = ☐ tens ☐ ones
F 75 = ☐ tens ☐ ones
G 82 = ☐ tens ☐ ones
H 63 = ☐ tens ☐ ones
I 94 = ☐ tens ☐ ones
J 71 = ☐ tens ☐ ones
K 84 = ☐ tens ☐ ones
L 23 = ☐ ten ☐ ones
M 58 = ☐ tens ☐ ones
N 36 = ☐ tens ☐ ones
O 60 = ☐ tens ☐ ones
P 49 = ☐ tens ☐ ones

3

4

A 1 ten 27 ones = 3 tens ☐ ones
B 4 tens 18 ones = ☐ tens ☐ ones
C 6 tens 35 ones = ☐ tens ☐ ones
D 2 tens 19 ones = ☐ tens ☐ ones
E 5 tens 22 ones = ☐ tens ☐ ones
F 3 tens 38 ones = ☐ tens ☐ ones
G 5 tens 11 ones = ☐ tens ☐ one
H 7 tens 29 ones = ☐ tens ☐ ones

5

A 3+7=☐
B 10÷2=☐
C 9−4=☐
D 5+3=☐
E 8÷4=☐
F 3×2=☐
G 7−5=☐
H 3×3=☐
I 10−7=☐
J 2×5=☐
K 7−3=☐
L 10÷5=☐
M 6÷2=☐
N 2+6=☐
O 5+5=☐
P 8÷2=☐
Q 6÷3=☐
R 7+2=☐
S 9−3=☐
T 8−5=☐
U 5×2=☐

50

1 Have the children read Problem A and look at the picture. Ask them whether what is happening in Picture A makes them think of adding or subtracting. Ask them what sign should be put in place of the wavy line in the equation to show this. Have someone answer the question in the problem by using the picture. Then help the children complete the equation.

2 Proceed in the same way for Problem B and its picture.

3 Have the children read this problem silently. Direct them to decide what sign should be put in the equation and to decide on the answer. Then let them take turns reading orally the problem and equation, naming the sign and supplying the answer. Let those who have difficulty use objects to show what is happening in the problem.

51

1 Have the children write the equations and supply the answers to Problems I to N, after you have worked through Problem I on the board with them. Then have each of several pupils write the equation for one of the problems on the board for discussion so that the others may check over their own work.

2 Have the children do this "Keeping skillful" as a separate activity.

3 Exercises A to P may be done orally. A few of them can be assigned as written work. Be sure the pupils understand that they are to change one of the groups of ten to 10 ones and put the 10 ones with the original number of ones.

4 For Exercises A to H, pupils need write only the answers. They are to change ones into tens so that there are fewer than 10 ones left.

5 For Exercises A to U, pupils may write the complete exercises, with the missing numbers inserted. These exercises may be used orally.

52-55 Moving forward

Expanded Notes for this lesson are on pages 236-239.

Objectives

The child learns the equivalent money values for the nickel, dime, quarter, and half dollar. In using money he learns to count by fives, tens, and twenty-fives in a meaningful way.

Vocabulary

New words page 52 half, dollar, coins; page 55 count*, using*

Old words page 52 cents, dime*, nickel*, quarter; page 55 money*

Comments

In this program money is developed after the number system is taught. Our money system is one of the applications of our number system, but it has certain features that make it a poor device to use in teaching operations with the number system. The importance of 5 and 25 in the monetary system is not matched in the number system itself.

The authors feel that in studying a unit on money, the children should have the opportunity to handle real money. Therefore, many of the activity suggestions for these pages suggest experiences with actual money. This does not mean that every child should be provided with all the coins to be used, nor that children should bring money from home. The teacher should provide enough coins for the various lessons so that a group of children can gather around a central place and work with the coins. If this is not feasible, markers representing coins can be made with a number symbol indicating the value printed on each.

To facilitate practice with money, the pictures show symbolized coins with their denominations indicated by the numerals 1, 5, 10, 25, and 50. This makes a large amount of practice possible and prevents the confusion that results from children's inability to distinguish between pictures of dimes, nickels, and quarters.

To help the children count by fives, tens, and twenty-fives meaningfully instead of by rote, a chart with the numerals 1 to 50 is provided at the top of page 52. Every fifth numeral is in red. By using these red numerals, children get a better idea of how counting by fives includes all the numbers not named in counting. The red numerals ending in zero can be used in the same way for counting by tens. The idea of counting by twenty-fives, needed in counting money, is suggested by the circled numerals. The chart should be used in connection with the work on pages 52 and 53 whenever necessary.

Children should receive practice in counting by tens by beginning with 5, 15, 25, etc. Counting in this way is often used with money.

Counting money in amounts in excess of 50¢ is taught on pages 148-151.

When coins are overlapped as a group, the group should be counted as one value, 5 pennies as 5 and 2 nickels as 10.

The work on page 54 shows the child how to count money by procedures used in business. In Pictures A to D, the child learns to say the cumulative numbers without saying "cents" until the entire amount is counted.

Children should learn to organize a group of coins before counting. The usual method is to begin with the largest coins and proceed to the smaller ones. Nickels and pennies may be grouped.

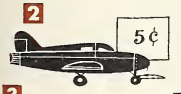
Moving forward

On pages 52 to 55 you will learn about coins. You will learn about the penny, the nickel, the dime, the quarter, and the half dollar.

1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	(25)	26	27			
28	29	30	31	32	33	34	35	36	37	38	39			
40	41	42	43	44	45	46	47	48	49	(50)				

2



3 A

4 D

B

E

F

nickel

5 cents
5¢

C

G

dime

10 cents
10¢

H

1

I

2

M

J

N

K

O

P

quarter

25 cents
25¢

L

Q

half
dollar

50 cents
50¢

R

3

S

T

U

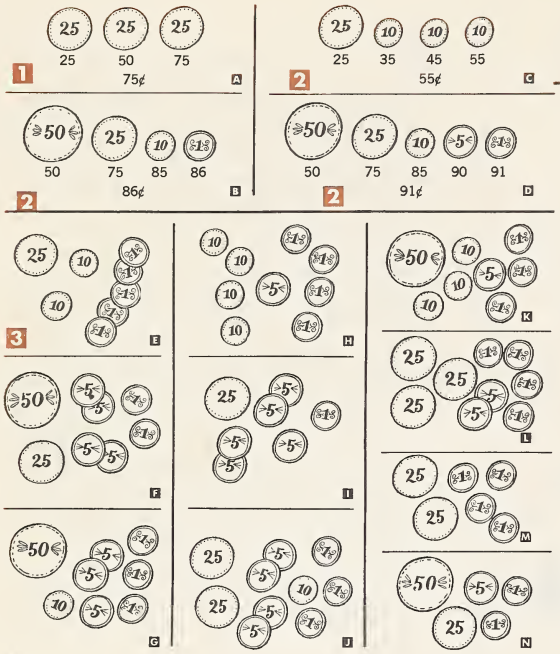
V

52

1. Direct attention to the fact that every fifth numeral on the chart is in red. Call on a pupil to read these numerals, and help the class see that counting by fives is really a short way of counting that includes all numbers not named in counting.
2. Before proceeding with the pictures use real coins. Have pupils count and stack 50 pennies by fives. Explain that another word for *penny* is *cent*, and write the *cent sign* on the board. Have the children place a nickel beside each group of five pennies. Then have them move the stacks of pennies together to make groups of ten and the nickels opposite them to make groups of two. Place a dime opposite each of these groups. Explain that each of these collections of different coins is worth 10¢.
3. Help pupils discover that the coins pictured in B and C can be used to buy the airplane.
4. Let the children discover that the coins in each picture (E to H) will buy the truck.

53

1. Pictures I to L are a unit developing the quarter. Ask a pupil to count the pennies by fives to find if there are enough pennies to buy the book. Ask another child to do the same with the nickels. With Picture L explain that the quarter will buy as much as the coins in Pictures J and K. Direct attention to the text in Picture L.
2. Pictures M to R are a unit developing the half dollar. Ask one pupil to count the pennies by fives to find if there are enough pennies to buy the dishes. Ask another child to do the same with the nickels; another to count the dimes by tens; and another the quarters. Let the children work with real coins. Show how to stack coins in orderly piles and to count each pile as a unit.
3. Pictures S to V provide practice in counting coins. The chart on page 52 may be used in counting them.



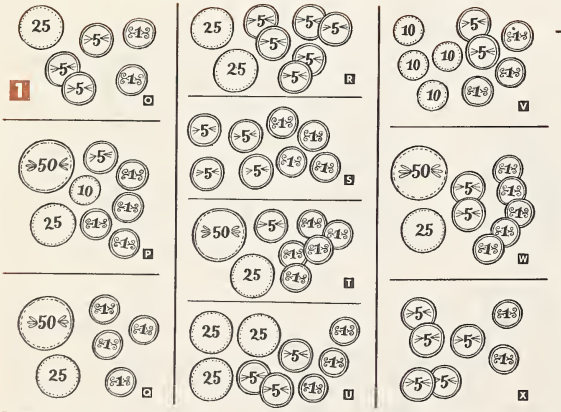
54

54

1 This picture shows how to count by twenty-fives. Ask how many pennies a quarter is worth. Have pupils check this with the number below the first quarter. Ask how much two quarters are worth. Have them check this against the number below the second quarter. Have them look at the number below the third quarter. Ask for another word for pennies. Have them find 75¢ written in Picture A.

2 Have children count the coins in this picture in the same way.

3 Let children take turns counting the money in Pictures E to N orally. They may also be asked to write for each picture the numbers they would say in counting the money.



55

1 Let children take turns counting the money in Pictures O to X orally. They may also be asked to write for each picture the numbers they would say in counting the money.

2 Exercises A to R may be written first, with the children filling in the missing numbers. Then let them take turns reading the exercises aloud and supplying the answers. If children have difficulty with Exercises J to R, show them how to use real coins or to draw coins like those in the book for the given amounts and for the unknown amounts.

A 1 nickel = ■ pennies
B 1 dime = ■ pennies
C 1 dime = ■ nickels
D 1 quarter = ■ pennies
E 1 quarter = ■ nickels
F 1 half dollar = ■ pennies
G 1 half dollar = ■ nickels
H 1 half dollar = ■ dimes
I 1 half dollar = ■ quarters

2

J 1 dime = 1 nickel ■ pennies
K 1 quarter = 1 dime ■ nickels
L 1 quarter = 2 dimes ■ pennies
M 1 quarter = 1 dime ■ pennies
N 1 quarter = ■ dimes 5 pennies
O 1 half dollar = ■ dimes 2 nickels
P 1 half dollar = 1 quarter ■ nickels
Q 1 half dollar = ■ dimes 4 nickels
R 1 half dollar = 4 dimes ■ nickels

Now you should know how to count money, using pennies, nickels, dimes, quarters, and half dollars.

56-58 Moving forward

Expanded Notes for this lesson are on pages 239-241.

Objectives

The child learns to make change with pennies, nickels, dimes, and quarters for amounts less than one dollar.

Vocabulary

New words page 56 your*, change*; page 58 draw, would*, say*

Old words page 58 as*, cost, man*, this*, wagon*

Comments

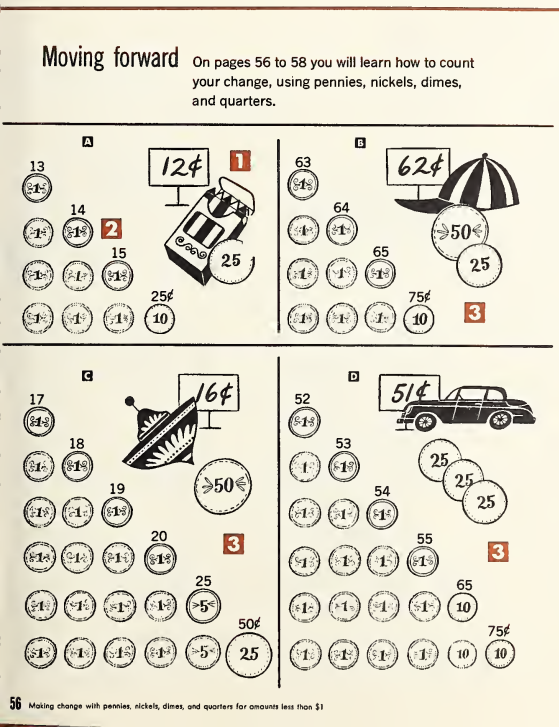
In learning how to make change the children apply what they have learned about counting coins. Since the actual making of change involves the handling of coins and making a verbal statement about the amount returned, children should have many opportunities to work with coins—either real coins or toy coins. Directions for making the toy coins will be found in the Expanded Notes for page 56.

The child should learn correct procedures in making change. He must learn to select the coins in a systematic manner and to count properly as he sets the coins aside. It will require much experience to enable the child to have confidence in making change.

Be sure the child learns to begin counting with the price of the article sold or purchased, and to use coins that will bring the first part of the change up to a convenient amount. Convenient amounts are those equal to a nickel, dime, quarter, or half dollar.

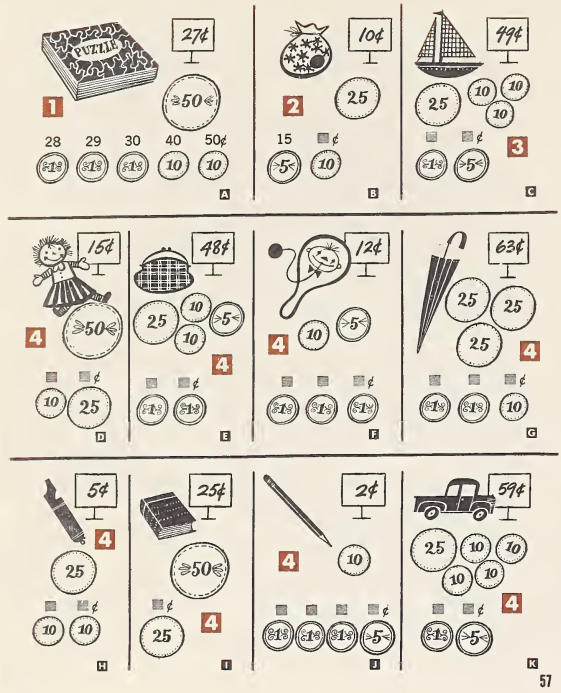
On page 56 the coins in each of the pictures are arranged to show the progression of counting as additional coins are put down. Previously counted coins are "dimmed off" in each row. The numerals in the diagonal row show how the counting is done. Each picture shows the price of the toy sold, the money offered in payment, and the coins given in change. Be sure the child knows that the rows of coins are really progressive views of what takes place. On page 57 the successive rows of coins are omitted.

Care should be taken to get the children to realize that in most situations change can be made in a variety of ways.



56

1. Have the children note how much the box of crayons costs and that the boy who bought it has given a quarter to pay for it. Raise the problem of how to make change.
2. Show the children how the clerk began counting change by saying "12" for the price of the article. Now draw attention to the rows of coins and explain that the coin in the first row shows the first coin given in change and that the number above shows what the clerk said. Have them look at the second row. Explain that one penny is dimmed off because it represents the penny already counted. Draw attention to the new coin and the number said by the clerk. Continue with the next two rows in the same way. Explain that the three pennies and the dime are the change the boy received from the clerk.
3. Proceed in the same way with this picture. If possible, let the children use real money in reënacting all the scenes.



57

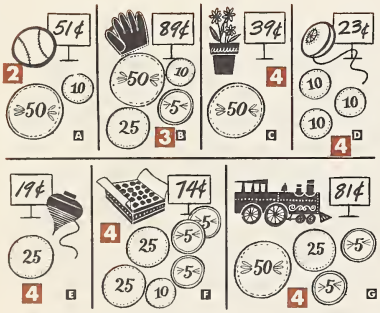
57

1 Have pupils look at Picture A. Ask questions about the cost of the puzzle and the amount given the clerk. Direct attention to the coins that were used to make change at the bottom of the picture. Have pupils take turns using real coins or toy money to count this change.

2 Use the same procedures for Picture B. Help the children decide what to say for the screen above the dime.

3 This is the first picture in which the children are not told what to say for each coin. Help them to see that 55¢ was given to the clerk. Ask them why they are to start counting with 49¢. Help them see that one cent will take them to the next coin (half dollar).

4 Treat this picture in the same way.



For each problem on this page, draw the coins that you would use in making change. Under each coin write the number you would say as you make the change. 1

H Don gave the man a half dollar for a hammer that cost 29¢. 5

I Carol bought a doll for 59¢. She gave the man 3 quarters. 6

J Tom bought a car for 43¢. He gave the man a quarter and 2 dimes.

K Nancy gave the man a dime for a bank that cost 5¢.

L Don bought a book for 17¢. He gave the man a quarter.

M Carol gave the man 90¢ for flowers that cost 82¢.

N Betty gave the man a quarter for a ball that cost 12¢.

O Jack bought a horn for 22¢. He gave the man 2 dimes and a nickel.

P Ellen gave the man 3 nickels for a toy wagon that cost 12¢.

Q Tom gave the man a quarter for a paintbox that cost 10¢.

R June gave the man a half dollar for a turtle that cost 27¢.

S Billy bought an apple for 6¢. He gave the man 1 dime.

Now you should know how to count change, using pennies, nickels, dimes, and quarters.

58

1 Have the children read these directions.

2 Work out the problem situation of Picture A. Help one child use real money in making the change. Be sure he counts properly. Draw on the board coins like those used in the pictures. Always indicate the value of the coin as is done in the text. Then under each coin write the number said as the coin is counted as change.

3 Go through the same activity with this picture.

4 For this picture have the children draw the coins and write under each what they would say as they make change.

5 Have the children look at Problem H. Be sure they understand how to draw the coins they would give in change and write the numbers they would say. If necessary, let a child use real or toy money in making change.

6 Have pupils draw and label the coins for Problems I to S, and write under each coin what they would say in counting the change.

59-60 Using arithmetic

Exponded Notes for these lessons are on poges 241-242.

Objectives

The child learns how to work with the verbal problem in paragraph form.

Vocabulary

New words page 59 May*, schoolbooks*, see*;
page 60 home*, last*, week*
Old words page 59 made*; page 60 horses*

Comments

The verbal problems on pages 50 and 51 provided the child with practice in handling the question type of problem. However, for ease of reading and comprehension, the sentences did not follow along in true paragraph style. Each sentence in a problem was started on a new line.

Now the children meet short problems in paragraph form. In Problems A to G, the necessary equations are partly set up. To solve the remaining problems, children must set up the complete equations themselves. Insist that each child make an equation (basic fact at this point) for each problem.

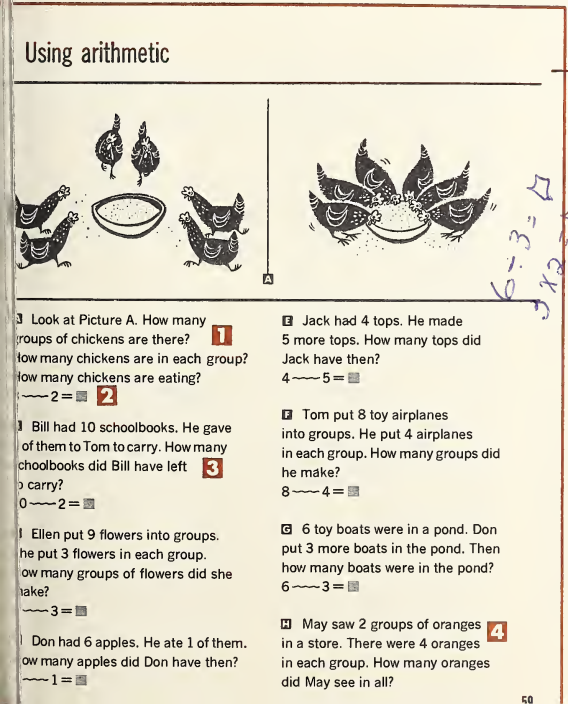
A "Keeping skillful" exercise providing practice on the basic facts through the 10 group appears at the bottom of page 60. It may be used as a separate lesson.

Answers

Using arithmetic:

The bracket indicates where the screen should be put. The numeral enclosed is the answer to the problem.

A 3×2=[6]	G 6+3=[9]	M 6+4=[10]
B 10−2=[8]	H 2×4=[8]	N 2×4=[8]
C 9÷3=[3]	I 10÷2=[5]	O 10÷5=[2]
D 6−1=[5]	J 4+5=[9]	P 8−2=[6]
E 4+5=[9]	K 4×2=[8]	Q 6+3=[9]
F 8÷4=[2]	L 8−3=[5]	R 8−2=[6]


Using arithmetic
A
roups of chickens are there?
low many chickens are in each group?
low many chickens are eating?
2 =
Bill had 10 schoolbooks. He gave
of them to Tom to carry. How many
choolbooks did Bill have left
carry?
0 2 =
Ellen put 9 flowers into groups.
he put 3 flowers in each group.
ow many groups of flowers did she
ake?
3 =
Don had 6 apples. He ate 1 of them.
ow many apples did Don have then?
1 =
Jack had 4 tops. He made
5 more tops. How many tops did
Jack have then?
4 5 =
Tom put 8 toy airplanes
into groups. He put 4 airplanes
in each group. How many groups did
he make?
8 4 =
6 toy boats were in a pond. Don
put 3 more boats in the pond. Then
how many boats were in the pond?
6 3 =
May saw 2 groups of oranges
in a store. There were 4 oranges
in each group. How many oranges
did May see in all?
50

59

1. Have the children read all of Problem A except the equation. Tell them to use both scenes of Movie A to answer the questions. Call on someone to read the questions aloud and answer them.
2. Tell pupils to look at the equation beneath the problem. Ask what the 3, 2, and the screen stand for. Ask questions that will help the children determine whether what is happening in the movie makes them think of adding or multiplying. Ask them what sign they should put in the equation, and what number should replace the screen.
3. For Problems B to H, ask questions that help the children "see" the problem situation, determine what is happening, and complete the equation.
4. Help them make the equation with the screen, then with the answer.

I June put 10 plants into groups. She put 2 plants in each group. How many groups did she make? 1

J There were 4 dolls on a shelf. Nancy put 5 more dolls on the shelf. How many dolls were on the shelf then? 2

K Jack put 4 groups of toy boats into a box. There were 2 boats in each group. How many toy boats did Jack put into the box?

L 8 birds were eating. 3 of them flew away. Then how many birds were eating?

M 6 horses were in the barn. 4 more horses came into the barn. How many horses were in the barn then?

N A man put 2 groups of apples into a basket. There were 4 apples in each group. How many apples did he put into the basket?

O June put 10 apples into groups. She put 5 apples in each group. How many groups did she make?

P Ellen had 8 candles in a box. She put 2 of them on the table. How many candles were left in the box?

Q Nancy made 6 doll hats last week. She made 3 more doll hats this week. How many doll hats did she make?

R Don had 8 toy boats at home. He took 2 of them to school. How many toy boats were left at home?

Keeping skillful 3

A 7+3=■	L 3×3=■	A 10−1=■	L 2+3=■
B 5+2=■	M 2×5=■	B 4×2=■	M 10−8=■
C 4+4=■	N 2×3=■	C 8÷2=■	N 7−2=■
D 6+3=■	O 9÷3=■	D 8+2=■	O 3+6=■
E 2+8=■	P 6+2=■	E 9−3=■	P 5−4=■
F 9−5=■	Q 4÷2=■	F 2×2=■	Q 6÷3=■
G 10−3=■	R 10−7=■	G 5+4=■	R 4+5=■
H 8−6=■	S 8÷4=■	H 10−5=■	S 3×2=■
I 7−4=■	T 9−7=■	I 3+7=■	T 6−4=■
J 9−8=■	U 6÷2=■	J 10÷2=■	U 3+4=■
K 2×4=■	V 10÷5=■	K 7+2=■	V 7−5=■

60

60

1 Tell the children to read Problem I and to write the equation with the screen; then to rewrite it with the answer. If a child has difficulty, help him act out the problem with objects.

2 Tell the children to work each of the remaining problems by making equations, using the screen first and then the answer. When they are through, discuss the problems with the class and help those who had difficulty.

3 The "Keeping skillful" should be handled as a separate lesson. For each set of exercises have the children write the letters A to V in a column on their papers and then write only the answer to each equation at the right of the proper letter.

61-63 Exploring problems

Exponded Notes for this lesson ore on pages 242-243.

Objectives

The child learns that there are problems in which additive and subtractive actions do not actually take place but must be imagined.

Vocabulary

New words page 61 first*, imagine, next*; page 62 belong, others*, peach; page 63 candy*, got*, missed
Old words page 63 some*

Comments

Up to now the children have been dealing with problems in which the type of situation (additive, subtractive, multiplicative, divisive) has been plainly shown or described in terms of appropriate action. In additive and multiplicative situations the groups have been described as actually joining, and in subtractive and divisive situations, as actually separating. Now they learn that there are situations in which it is impossible or undesirable for groups of objects to be joined or separated. The problems pictured and described on pages 61 and 62 illustrate additive and subtractive situations of this type.

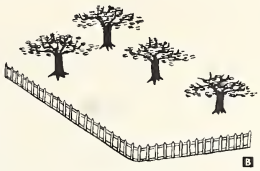
On page 62 the device called "dimming off" is used to indicate the subgroup of objects that the child is to imagine as being taken away from the whole group.

Answers

Exploring problems:

When the action in an additive situation is to be imagined only, the child has a choice of which group to think of as joined to the other group. For this reason two equations are given for each such problem. Later (pages 130-133) the child learns that the order of the numbers added does not affect the answer.

C 9−5=[4]
D 10−4=[6]
E 4+3=[7] or 3+4=[7]
F 7−4=[3]
G 4+6=[10] or 6+4=[10]
H 5+5=[10]
I 9−7=[2]
J 2+3=[5] or 3+2=[5]
K 6−2=[4]
L 5+3=[8] or 3+5=[8]



A Look at Pictures A and B first. There are 5 trees in Don's yard and 4 trees in Betty's yard. How many trees are there in all? 1

Next imagine that the two groups of trees are being put together into one group. Look at Picture C.
5 + 4 = ■
There are ■ trees in all. 2

B Tom has 3 toy cars, and Don has 5 toy cars. How many toy cars have the boys in all?

Imagine that the two groups of cars are being put together. 3
Look at Picture D. 3 + 5 = ■
The boys have ■ toy cars in all.

Problem situations where objects cannot be moved or where moving them is not desirable 61

A There are 7 trees in the yard. 4 of them are apple trees. The others are peach trees. How many are peach trees? 1

Imagine that 4 trees are being taken away from 7 trees. Look at Picture A.
7 − 4 = ■
■ of the trees are peach trees. 2

B Carol and Don have 8 books. 2 of the books are Don's. The others are Carol's. How many of the books are Carol's? 3

Imagine that 2 books are being taken away from 8 books. Look at Picture B.
8 − 2 = ■
■ of the books are Carol's.

C There are 9 cars in a box. 5 of them belong to Don. The others belong to Bill. How many cars belong to Bill? 3

Imagine that 5 cars are being taken away from 9 cars. Look at Picture C.

D 10 ducks are in a pond. 4 of them belong to Tom. The others belong to Jack. How many belong to Jack? 3

Imagine that 4 ducks are being taken away from 10 ducks. Look at Picture D.

61

1 Have the children read just the problem and look at Pictures A and B to see the problem situation.

2 Now have them read the five lines explaining Problem A. Point out that Picture C shows how we might imagine the 4 trees as joining the 5 trees. Suggest that they close their eyes and try to "see" this. Have them imagine the action as completed and the group of 9 that results. Ask them to complete the equation. Next ask them to imagine the action taking place in another way—with the 5 trees joining the 4 trees. Ask what the equation would be then and what the answer would be.

3 Problem B and its picture may be handled in the same way. Be sure to have the children also imagine the 3 cars as joining the 5 cars.

62

1 Have the children read just the problem first and look at the first scene of Picture A to see the problem situation.

2 Ask them to read the four lines that explain Problem A. Draw attention to the second scene of Picture A. Explain that they can find out how many of the 7 trees are peach trees if they take away the 4 apple trees. Explain that the picture shows how to imagine this as done. Ask them to imagine the dimmed-off trees as gone. The children can see from the picture how many peach trees are left. Since the imaginary action indicated is the taking away of a part of a group, the children should see that subtraction is involved and should know what kind of an equation to make to solve the problem. Have them look at the equation, give the answer, and then complete the sentence that follows.

3 Proceed in the same way with this problem. Be sure to have the children make the equation.

E There are 4 flowers on Carol's plant and 3 flowers on May's plant. How many flowers are there in all? 1

F There are 7 toy cars on the table. 4 of them are Tom's. The others are Bill's. How many toy cars are Bill's? 2

G At the store Carol got 4 drawing books, and Ellen got 6 drawing books. The two girls got how many drawing books at the store? 3

H Tom saw 5 birds in his yard. Jack saw 5 birds in his yard. How many birds in all did they see?

I 9 spools are in a box. 7 of them are Ellen's. The others are June's. How many spools are June's?

J June missed 2 days of school last week. She missed 3 days this week. How many days did she miss in all?

K 6 dogs are playing. 2 of them are big, and the others are little. How many are little?

L Tom says that he has 5 pictures of dogs at home and 3 pictures of dogs at school. He has how many pictures of dogs in all?

In some problems, groups are put together or separated. In other problems you imagine that the groups are put together or separated.

Keeping skillful 4

For each of the next problems, first draw the coins that you would use in making change. Then write under each coin the number that you would say as you make change.

A Jack bought a top for 27¢. He gave the man 2 quarters.

B Don gave the man a half dollar for a hammer that cost 36¢.

C Jack bought some candy for 13¢. He gave the man a dime and a nickel.

D Ellen bought a painting book for 29¢. She gave the man a quarter and a dime.

E Bill bought a bank for 32¢. He gave the man a quarter and a dime.

F Carol gave the man 2 quarters, 2 dimes, and a nickel for a doll that cost 73¢.

G Betty bought oranges for 63¢. She gave the man 2 quarters and 2 dimes.

63

63

1 Direct the children to read the problem, the to decide whether they should think of th groups as joining or think of part of the grou as taken away. Permit discussion about th decision and about whether the joining or tak ing away is really done in the problem situ ation or is to be only imagined as happening Then require each child to write the equatio first with the screen and finally with the an swer. Use objects, if necessary, to show th action.

2 Proceed in the same way with this problem

3 Instruct the children to work independently o Problems G to L. Assist those who need help

4 Handle this exercise as a separate activity Have the children follow the directions give at the beginning of the section. Tell them t label each coin with its money value.

64-65 Moving forward

Expanded Notes for this lesson are on pages 243-245.

Objectives

The child learns to regroup quantities of 11 to 18 objects into ten and ones as preparation for understanding the basic facts for the groups beyond 10.

Vocabulary

New words page 64 larger*, work*

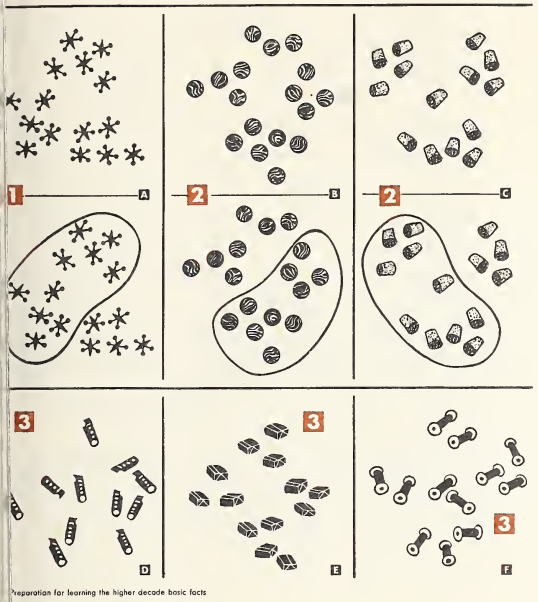
Comments

Pages 64 and 65 provide children with experiences in recognizing a group of 10 within a larger group containing as many as 18 objects. When they see the total group as made up of a group of 10 and several ones, they can easily discover how many there are in all without counting. Principles of the number system already learned (grouping by tens and ones) are used with the work on these pages.

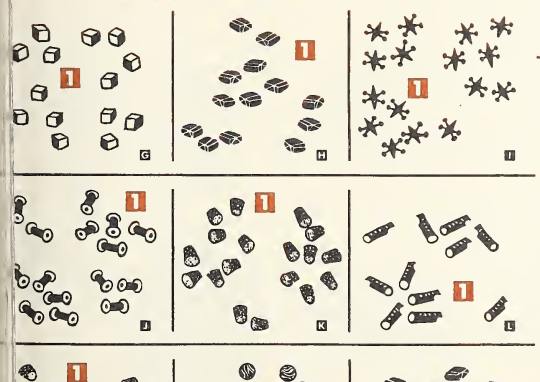
Children will benefit from as much experience in recognizing groups as it is possible to give them. The children can work in groups, one child throwing dow small objects (stones, jacks, bottle caps, etc.) in lots 10, 11, 12, etc., for the others to recognize by quantit This activity can be a game to find out who can reco nize the most groups. In the book, a ring (or line) drawn around the group of 10. To assist the childre at first in recognizing the group of 10 in a larger grou of objects, let them arrange a string around the grou of 10. Let children take turns showing how each "see the group of 10. There are certain to be several ways.

Moving forward

On pages 64 and 65 you will learn to see a group of 10 in a larger group. You will work with groups as large as 18.



Preparation for learning the higher decade basic facts



1 ten 7 ones = ▦
1 ten 1 one = ▪
1 ten 3 ones = ▦
1 ten 8 ones = ▦

2

E 1 ten 6 ones = ▦
F 1 ten 4 ones = ▦
G 1 ten 2 ones = ▦
H 1 ten 5 ones = ▦

I 18 = ▦ ten ▦ ones
J 13 = ▦ ten ▦ ones
K 17 = ▦ ten ▦ ones
L 14 = ▦ ten ▦ ones

Now you should know how to see a group of 10 in a larger group.

64

1 Ask the children if they think there are more than 10 jacks in the first scene of Movie A. Ask them how they would regroup these jacks to see more easily how many there are. If necessary, remind them about grouping by tens. Call attention to the second scene showing a group of ten set off by the red ring and the extra 5 single objects. Let the children discover that all they need to do to say the number is to say "fifteen," the "fif" for five single objects and "teen" for the group of ten.

2 Treat this picture in the same way.

3 Have pupils first find a group of 10 objects and then note how many extra ones there are. Tell pupils they may cover the group of ten with their hands or a piece of transparent paper. A ring may be drawn on the paper around the group of 10. Then they should be able to tell how many there are in all.

65

1 Direct each child to cover with his fingers a group of 10; then ask him to note the number of extra ones. A good procedure is to give each child a piece of transparent paper to fasten to the page. Direct him to draw a ring around a group of 10 for each of the pictures G to O. Tell him to write on the paper the total number of objects next to the letter in each picture.

2 Do these exercises orally first. Ask the children called upon to say the answer and also to give the letter of a picture on page 64 or 65 that shows the number. The answers may then be written.

66-70 Moving forward

Expanded Notes for this lesson are on pages 245-247.

Objectives

The child learns the addition and subtraction basic facts for the 11 group (the basic facts whose sums and minuends are 11).

Vocabulary

New words page 67 Ann*, show*; page 69 marching, without*, pilots, riding*

Comments

The children have already learned the basic facts through the 10 group. In studying them, they worked with pictures showing groups of objects combining or separating and carried out combining or separating actions themselves with real objects.

The block of work on pages 61-63 introduced the idea of imagined action. The children learned that in problems involving objects that cannot actually be combined or separated they must imagine these actions to set up the equation they need to solve the problem.

From now on, in studying the basic facts beyond the 10 group, pupils will meet and make use of both real and imagined actions. When the problem situation requires real action, the action of combining or separating will be shown in the book. When the situation is one in which no combining or separating really takes place, imagined action will be indicated.

In a situation where two groups of objects do not move together into one group, but in which the sum is required, the imagined joining will be indicated by a dotted background (see the last two scenes of Movies C and D, page 66). This dotted background will be referred to as a "binder" in these lesson briefs. Be sure the children understand that it indicates that they are to think of the groups as combined.

Where it is necessary to imagine one group separating into two groups and one of the groups as being removed, the group to be imagined away is dimmed off. (See page 68, the last scenes of Movies C, D, and E for examples.)

Whenever joining must be imagined, two equations can be presented, since it is possible to imagine either group joining the other. (See Movie C, page 66, where the basic facts $9+2=11$ and $2+9=11$ are presented or Movie F, page 67, where $5+6=11$ and $6+5=11$ are presented.)

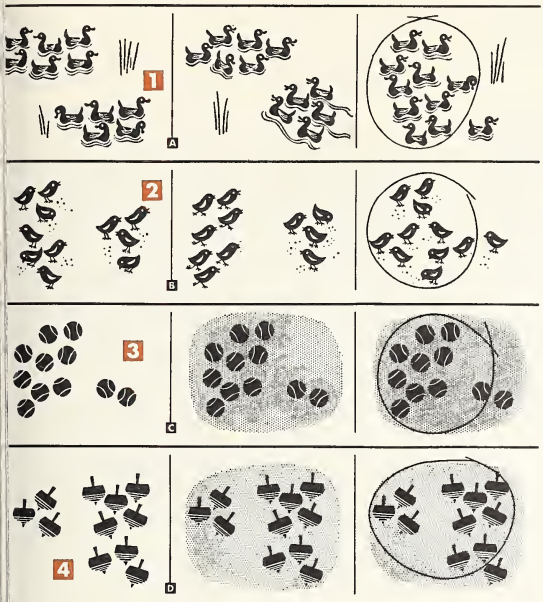
Page 66 presents pictorially the basic facts $6+5=11$, $4+7=11$, $9+2=11$, $2+9=11$, $3+8=11$, and $8+3=11$. Page 67 shows some of these facts in symbols as equations. Page 68 presents pictorially the basic facts $11-2=9$, $11-5=6$, $11-4=7$, $11-9=2$, and $11-3=8$. Page 69 shows some of the subtraction basic facts for the 11 group as equations. Page 70 provides practice exercises on the newly learned basic facts for the 11 group and reviews some of the other basic facts.

A word must be said here as to the commonly accepted definition of a basic fact beyond the 10 group. For any three numbers involved, two must be one-figure numbers. Thus $9+2=11$ satisfies this requirement, but $10+1=11$ does not and is not a basic fact.

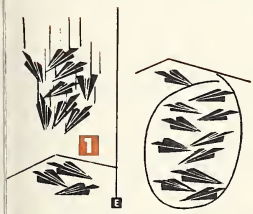
In presenting the basic facts for groups above 10 the technique of regrouping objects into a group of ten and extra ones is again used. As a visual aid a ring is drawn around a group of 10, so that children can quickly, without counting, "see" ten and the number of extra ones and thus recognize the total number easily.

Moving forward

On pages 66 to 70 you will learn to add to make 11 and also to subtract from 11.

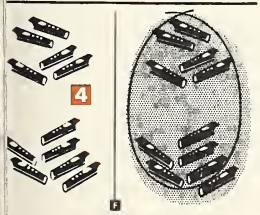


The addition and subtraction basic facts for the 11 group



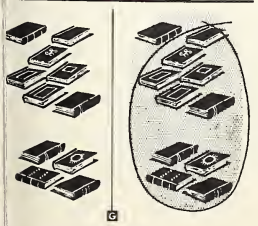
3 airplanes were on a table.
Don put 8 more airplanes on the table.
Then how many airplanes were on the table? 2

3+8=■



Tom had 5 whistles. 3
Bill had 6 whistles.
How many whistles did the boys have in all?

5+6=■ 6+5=■ 5



Betty took 7 books to school to show the other children. 6
Ann took 4 books to school to show them.
How many books in all did the girls take to school?

7+4=■ 4+7=■

66

1 For the first scene of Movie A ask, "How many ducks are in one group? How many are in the other group?" For the second scene ask, "What is happening? What does this action suggest?" For the third scene call attention to the group of ten in the ring and the extra one. Help the pupils see that the equation "6+5=11" tells what happened in the movie.

2 Use the same procedure for Movie B.

3 First let the children decide that no action takes place in Movie C, and that they must imagine one group as joining the other. Ask how many are in each group. Explain that the objects do not actually move in the second scene, but that the blue background helps them imagine the balls as one big group. For the third scene ask how many there are in the total group. Help pupils see that two equations can be made for this movie: 9+2=11 and 2+9=11.

4 Use the procedure of Note 3 for Movie D.

67

1 Have the children look at the first scene of Movie E to find out how many airplanes there are in each of the groups. Ask what is happening. Then have them look at the second scene to find how many airplanes there are in all.

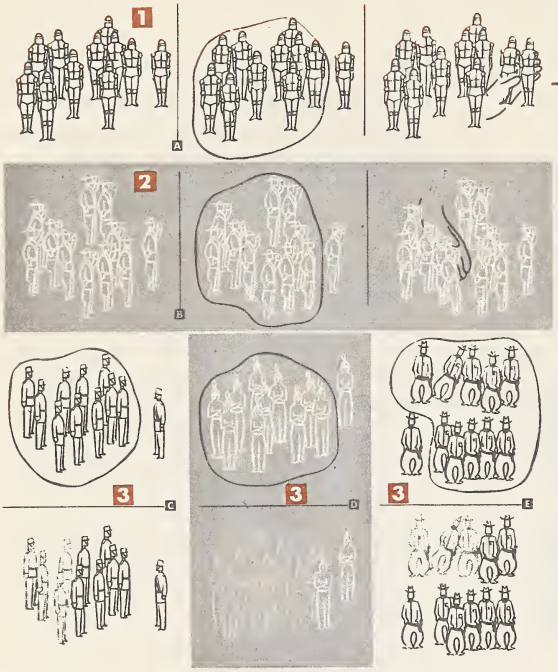
2 Have pupils read this problem and the equation. Tell them to use Movie E for information.

3 Have pupils read Problem F (not the equations).

4 Ask them to find in the first scene of Movie F Tom's whistles and Bill's whistles. For the second scene explain that the whistles have not been really put together, but that the blue background can help them imagine that the two groups of whistles are one big group. Ask how many there are in all.

5 Note the two equations. Get the children to see that the first equation means that they imagine that the group of 6 joined 5, and that the second equation means that they imagine that the group of 5 joined 6.

6 Apply Notes 3, 4, and 5 to this problem.



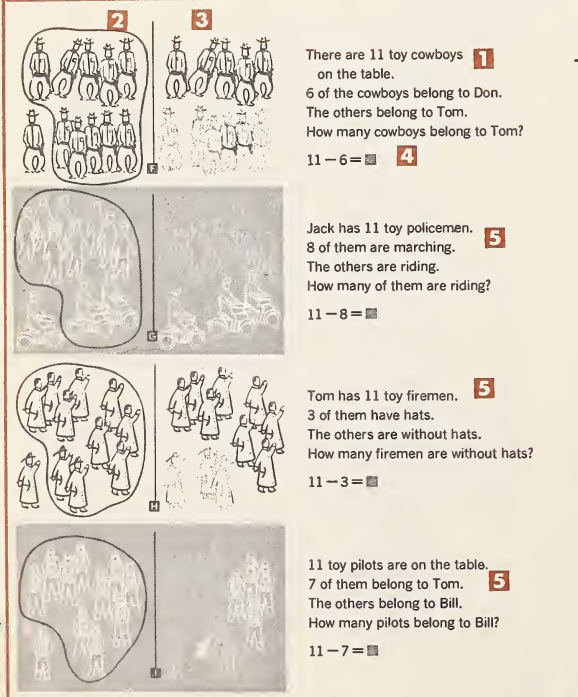
68

68

1 Ask: "Do you think there are more than 10 knights in the first scene? What does the second scene show? How many knights are there in all? In the third scene the hand is taking away how many knights? When we take part of a group away from the whole group, does this make you think of adding or subtracting? When the two knights are gone, how many will be left?" Get the children to verbalize the situation first as, "11 knights minus 2 knights equal how many knights?"; then as, "11 minus 2 equals 9." Have one child write this equation on the board.

2 Proceed in the same way with this movie.

3 For this movie ask questions similar to those above. Point out that the first scene of the previous movies is now missing. Point out also that the dimmed off group in the second scene of each movie represents the group that should be imagined as taken away.



69

69

1 Have pupils read all of the problem for Movie F except the equation.

2 Ask them how they can tell how many cowboys there are in the first scene of Movie F without counting.

3 Ask what is different about the second scene. Have children place a marker on Don's cowboys or point to them. Bring out that the dimmed-off cowboys suggest that they should think of Don's as being taken away. Ask how many cowboys are dimmed off from the total group of 11. Direct attention to the group not dimmed off and make clear that they should imagine these as the ones left and as Tom's. Ask, "How many belong to Tom?"

4 Have pupils read this equation and give the missing number, which they have found from the second scene of the movie. Let them show in Scene 2 what each number stands for.

5 Adapt Notes 1 to 4 to this problem.

A 5+6=■
D 11−8=■
G 11−3=■
D 2+9=■
E 4+7=■
F 11−2=■
G 6+5=■
H 11−9=■

I 3+8=■
J 7+4=■
K 11−5=■
L 11−7=■
M 9+2=■
N 11−6=■
O 8+3=■
P 11−4=■

A 10÷2=■
B 4×2=■
C 11−2=■
D 3+6=■
E 7+3=■
F 8÷2=■
G 9÷3=■
H 4+7=■

I 3×2=■
J 11−4=■
K 6÷2=■
L 9+2=■
M 10−4=■
N 8+3=■
O 11−7=■
P 5+6=■

Now you should know how to add to make 11 and also how to subtract from 11.

Using arithmetic

A Betty had 10 peaches. She ate 3 of them. She had how many peaches left?

B Tom saw 5 birds in a tree, and Jack saw 6 birds in another tree. How many birds in all did they see?

C Don had 9 toy pilots. He gave 3 of them to Tom. Then Don had how many toy pilots?

D There were 11 hammers in the store. The boys bought 3 of them. How many were left?

E June had 3 cookies. Her mother gave her 2 more. Then June had how many cookies?

F Nancy has 11 flowers. 9 of them are red, and the others are yellow. How many of them are yellow?

G Ellen had 3 apples. She bought 8 more apples. Then she had how many apples?

H June has 2 kittens, and Carol has 5 kittens. The girls have how many kittens in all?

I Don had 4 tops on Monday. On Tuesday he bought 7 more tops. Then he had how many tops?

J May has 11 plants. 6 have flowers. The others are without flowers. How many plants are without flowers?

K Don read 3 books last week. He read 5 books this week. How many books in all did he read?

L Mother put 8 cookies on a plate. Bill ate 2 of them. How many cookies were left on the plate?

70

1 The children may take turns reading and answering these exercises orally. Then you may have all the children write the complete equations with answers.

70 Using arithmetic

xpanded Notes for this lesson are on page 247.

bjective

he child practices solving verbal problems involving ll four processes.

ocabulary

lew words page 70 another*, Monday, Tuesday ld words page 70 red*, yellow*

omments

Vith this problem set, children are given a chance to pply their newly acquired knowledge about the addiion and subtraction basic facts for the 11 group in lving problems.

The problems involve both real and imagined action. or the first time in a "Using arithmetic" problem set no ustrations are provided as a help. The child must sualize the problem situation.

Assign these problems as written work. When everyne has finished, have the problem equations and solutions put on the board by different pupils for discussion. The rest of the class may then check their own work.

Answers

Note that for Problems B and H the equation may be expressed in either one of two ways.

A 10−3=[7]
B 5+6=[11] or 6+5=[11]
C 9−3=[6]
D 11−3=[8]
E 3+2=[5]
F 11−9=[2]
G 3+8=[11]
H 2+5=[7] or 5+2=[7]
I 4+7=[11]
J 11−6=[5]
K 3+5=[8]
L 8−2=[6]

A 5+6= B 11−8= C 11−3= D 2+9= E 4+7= F 11−2= G 6+5= H 11−9=

I 3+8= J 7+4= K 11−5= L 11−7= M 9+2= N 11−6= O 8+3= P 11−4=

A 10÷2= B 4×2= C 11−2= D 3+6= E 7+3= F 8÷2= G 9÷3= H 4+7=

I 3×2= J 11−4= K 6÷2= L 9+2= M 10−4= N 8+3= O 11−7= P 5+6=

Now you should know how to add to make 11 and also how to subtract from 11.

Using arithmetic 1

A Betty had 10 peaches. She ate 3 of them. She had how many peaches left?

B Tom saw 5 birds in a tree, and Jack saw 6 birds in another tree. How many birds in all did they see?

C Don had 9 toy pilots. He gave 3 of them to Tom. Then Don had how many toy pilots?

D There were 11 hammers in the store. The boys bought 3 of them. How many were left?

E June had 3 cookies. Her mother gave her 2 more. Then June had how many cookies?

F Nancy has 11 flowers. 9 of them are red, and the others are yellow. How many of them are yellow?

G Ellen had 3 apples. She bought 8 more apples. Then she had how many apples?

H June has 2 kittens, and Carol has 5 kittens. The girls have how many kittens in all?

I Don had 4 tops on Monday. On Tuesday he bought 7 more tops. Then he had how many tops?

J May has 11 plants. 6 have flowers. The others are without flowers. How many plants are without flowers?

K Don read 3 books last week. He read 5 books this week. How many books in all did he read?

L Mother put 8 cookies on a plate. Bill ate 2 of them. How many cookies were left on the plate?

70

70

1 These problems should first be done by the children independently of your aid. Tell them first to read the problem, then to think about the action, and finally to make an equation, first with the screen, then with the answer. When the children have finished, discuss those problems that many children missed. Help individuals with their special difficulties not encountered by the majority of the class. The slower children may gain insight by using objects to show what happens in a problem.

71 Side trip

Expanded Notes for this lesson are on pages 247-248.

Objectives

The child practices using the calendar.

Vocabulary

New words page 71 months, Saturday*, year*

Old words page 71 same*, shortest*, which*

Comments

This page was designed to help you find out how familiar the children are with the calendar. The ability to read and use a calendar is something that must be regularly taught over the years. Some children grasp the idea at the first-grade level, while others do not until much later. This lesson is the first of a series of "Side trips" in the book, designed to enrich and extend the general ideas of arithmetic.

There is no substitute for a real and current calendar. One should always be visible in the room and daily observations made about it. Special emphasis needs to be put on the fact that the calendar shows Sunday as the first day of the week.

Give attention to the two groups of holidays: those fixed by date (Christmas, Independence Day, etc.) and those that are not (Labor Day, Thanksgiving Day, etc.).

1 Side trip

JANUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

FEBRUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

MARCH

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

APRIL

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

MAY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

JUNE

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

JULY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

AUGUST

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

SEPTEMBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

OCTOBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

NOVEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

DECEMBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

2

A Tom's birthday is on May 1. Will he be in school that day?
B March 25 is on what day?
C June 12 is on what day?
D What day is your birthday? Will you be in school that day?
E Was your birthday on a school day last year?
F Will your birthday be on a school day each year?
G What are the first and last days of the week?
H The last day of May is what day of the week?
I The first day of June is what day of the week?
J Will the last day of May be the same day of the week next year as it is this year?
K Will the first day of June be the same day of the week next year as it is this year?
L How many months are there in a year?
M How many days are there in a week?
N Which month is shortest?
O The first day of the year was Saturday. What will be the first day of the next year?
P Tuesday was the first day of which months?

3

71

1 Let the children compare the current calendar with the one printed here to see if they are the same. Suggest that they compare first the current calendar month with the one for the same month in the calendar in the book. Then have them check the other months.

2 Have the children write the letters A to P in a column on paper. Tell them to read each question silently, then look at the calendar on this page for the month indicated, and answer the question. When all have finished this work, go over the questions orally. Work on this page may be continued by the children in independent groups. The children may take turns asking questions such as these: "Look at the February calendar. What day does the 10th come on? What are all the Friday dates for June? Name all the months that have 30 days in them. Which months have 31 days?"

3 Now have the children answer Questions A to P by using the current year's calendar.

72-74 Exploring problems

panded Notes for this lesson are on pages 248-250.

bjectives

he child learns why he can subtract to find the answers o problems in which he is asked to find how many more r fewer there are in one group than another. He also eviews basic facts and regrouping in the "Keeping illful" exercise.

ocabulary

ew words page 72 compute, fewer*, gone*, match, ust*, not*; page 74 smaller*, spent, these*

ld words page 72 than*; page 73 buying*; page 74 uch*

mments

o to this time children have met only one type of subactive situation—the how-many-are-left type. With e problems in this block of work, children meet a new uation—the how-many-more-than (or the how-many-wer-than) situation. This type involves a comparison between the number of objects in one group and the number of objects in another group. Through pictures that help children see or imagine a subtractive action in the situation, they begin to understand why subtraction is used to solve such problems. Attention to the kind of thinking involved in following through this type of problem situation shows that we do not take "plates from cups," or try to subtract unlike objects. To demonstrate the solution, we must take part of a group (for example, cups) from the entire group (of cups), and thus show a genuine subtractive situation.

Pages 72 and 73 provide pictures and explanations for solving this "how-many-more-than" type of problem. Page 74 provides some practice problems. There is also another "Keeping skillful" exercise to review and maintain basic facts and regrouping of numbers.

With this block of work on "Exploring problems," a new labeling device is introduced. The pictorial material illustrating the situation and showing the child how to make the equation is labeled "See." The arithmetic

necessary to solve the equation is labeled "Compute." At this stage only basic facts can be used in the problems. Therefore, most children can give answers immediately. Insist, however, that each child make an equation for each problem. They should write the equation with a screen first to show the unknown number, then with the answer. Although actual computation is unnecessary here, the "Compute" step builds a pattern of response that will be necessary in solving the more difficult problems that come in later lessons.

Note that objects to be imagined as gone are dimmed off in the pictures. One very important thing is to get the children to understand that the group imagined as removed is equal to the smaller whole group of objects being compared.

The word *fewer* (not *less*) is used in the text in all situations in which one *number* of objects is compared with another *number* of objects. This is the correct word to use in such situations, but do not require children to make the distinction between the use of *fewer* and *less*. The word *less* will be used correctly in situations in which one *amount* is compared with another *amount* without reference to the *number* of separate items (fewer *lumps* of sugar, less sugar; fewer dollars; less money).

Note that Problem I on page 74 is of the additive type. In each set of problems that introduces a new skill, one or more problems involving previously taught skills will be included. This is done to prevent the child's following the pattern of the new type problem without thinking.

Answers

When a lesson contains several blocks of separately lettered exercises, they will be referred to as Block 1, Block 2, etc., in the answer key.

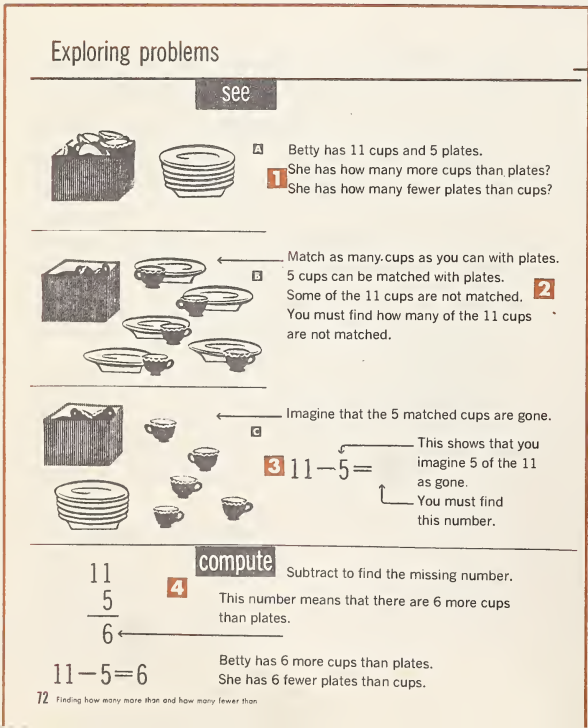
Exploring problems:

D 11−7=[4] F 8−6=[2] H 5−3=[2]
E 10−7=[3] G 10−9=[1] I 6+5=[11]

Keeping skillful:

(block 2)

A 5 tens 7 ones
B 4 tens 14 ones
C 8 tens 13 ones
D 6 tens 8 ones
E 7 tens 11 ones


Exploring problems
see
A
Betty has 11 cups and 5 plates.
1
She has how many more cups than plates?
She has how many fewer plates than cups?
B
Match as many cups as you can with plates.
5 cups can be matched with plates.
Some of the 11 cups are not matched.
You must find how many of the 11 cups are not matched.
2
C
Imagine that the 5 matched cups are gone.
3
11−5=
This shows that you imagine 5 of the 11 as gone.
You must find this number.
compute
11
5
6
4
Subtract to find the missing number.
This number means that there are 6 more cups than plates.
11−5=6
Betty has 6 more cups than plates.
She has 6 fewer plates than cups.
72 Finding how many more than and how many fewer than

72

1 Have the children read the problem and note how Picture A illustrates the situation.

2 Ask pupils to read the explanatory materia at the right of Picture B and note how Picture B shows that 5 of the cups have been matched with the plates.

3 Ask them to read the material at the right o Picture C. Call attention to the dimmed-of cups in Picture C that show that 5 of the 1 cups may be imagined as being taken away They are the ones that matched the 5 plates When they are taken away from the total o 11 cups, the number of cups left will show how many more cups there are than plates. Help the children realize that such "taking away" of one group should make them think of subtracting and that the equation stands for wha they see in the picture.

4 Explain that in the section entitled "Compute" they are to find the answer. Show that the answer, 6, has been put in the equation.

see

A Mother is buying 9 peaches and 7 apples. How many more peaches than apples is she buying? She is buying how many fewer apples than peaches? 1

B How many peaches can you match with apples? 2
Some of the 9 peaches are not matched. You must find how many of the 9 peaches are not matched.

C Imagine that the 7 matched peaches are gone. 3

$9-7=$ ▢
- This shows that you imagine 7 of the 9 as gone.
- You must find this number.

compute Subtract to find the missing number. 4

$$\begin{array}{r} 9 \\ -\ 7 \\ \hline \end{array}$$

This number means that there are ▢ more peaches than apples.

Mother is buying ▢ more peaches than apples. 5
She is buying ▢ fewer apples than peaches.

$)-7=$

73

Ellen has 10 forks and 4 spoons.
e has how many more forks than
oons? 1

Number of forks.
- Number of forks matched with spoons. Imagine these as gone.
- Number of forks not matched with spoons.
- You must find this number.

$)-4=$

btract 4 from 10.
ere are ▢ more forks than spoons.

Ellen has how many fewer spoons
n forks? 2

Nancy has 11 doll hats and 5 dolls.
d how many more doll hats she
s than dolls.
$-5=$▢

D Betty made 11 baskets. Ann made 7 baskets. Ann made how many fewer baskets than Betty?

E Bill had 10¢. He spent 7¢ for an orange. He had how many cents left?

F Carol spent 8 pennies, and Don spent 6 pennies. Don spent how many fewer pennies than Carol?

G Jack saw 9 ponies, and Tom saw 10 ponies. How many fewer ponies did Jack see than Tom?

H Don gave 5 toy pilots to Bill. He gave 3 toy pilots to Jack. He gave how many more pilots to Bill than to Jack?

I Betty painted 6 pictures, and June painted 5 pictures. The girls painted how many pictures in all?

Now you should know how to find how much larger or smaller one group is than another.

eping skillful 3

$11-8=$▢	H $5+3=$▢	O $3+8=$▢	A 2 tens 37 ones = ▢ tens 7 ones
$4+1=$▢	I $11-9=$▢	P $8-5=$▢	B $54=4$ tens ▢ ones
$3+7=$▢	J $10\div5=$▢	Q $6\div2=$▢	C $93=$▢ tens 13 ones
$8\div4=$▢	K $4\times2=$▢	R $10-7=$▢	D 5 tens 18 ones = ▢ tens 8 ones
$3-2=$▢	L $9-6=$▢	S $7-4=$▢	E $81=7$ tens ▢ ones
$5+4=$▢	M $4-3=$▢	T $2+9=$▢	
$3\times3=$▢	N $2+4=$▢	U $7+2=$▢	

73

1 Have the children read the problem and note how Picture A illustrates the situation.

2 Ask pupils to read the explanatory material at the right of Picture B and note how Picture B shows that 7 of the 9 peaches have been matched with the 7 apples.

3 Ask them to read the material at the right of Picture C. Call attention to the 7 dimmed-off peaches in Picture C. This shows that 7 of the 9 peaches may be imagined as taken away. Point out that the equation stands for what they see in the picture. Discuss what each number and the screen stands for.

4 Have them read the first sentence and give the answer. Then have pupils read the second sentence, saying the missing number. Call on someone to complete the equation.

5 Have them match these two sentences with the two questions in the problem opposite Picture A.

74

1 Work through this problem and its explanation orally with the class. Be sure the children understand what each number in the equation stands for, as explained by the material with the arrows.

2 Have them do Problems B to I independently as written work. Tell them to place the letters on their papers and after each to write the equation with the screen, then to write it again with the answer. When the class has difficulties, discuss the equations with the children so that the numbers can be explained as in Problem A.

3 As a separate activity assign these exercises as practice and maintenance work. Have the children write the letters A to U on their papers with the answers for each exercise. Exercises A to E on the number system may be done in the same way.

75-78 Exploring problems

Expanded Notes for this lesson are on pages 250-252.

Objectives

The child learns to subtract to find how many were added or how many more are needed.

Vocabulary

New words page 75 give*, leaves*, turn*; page 76 does*, think*, wants*, why*; page 77 balloon*, cupcakes*, get*; page 78 able, caps*, dresses*, save* Old words page 75 do*; page 76 need*; page 77 bears*; page 78 milk*

Comments

Problems of the additive-subtraction type have quite frequently given children trouble. The problem *sounds* as if addition were involved. Indeed, when the problem situation is carried out with objects, the action is that of combining. Yet the actual computation involves subtraction. Children may well ask, "Why?"

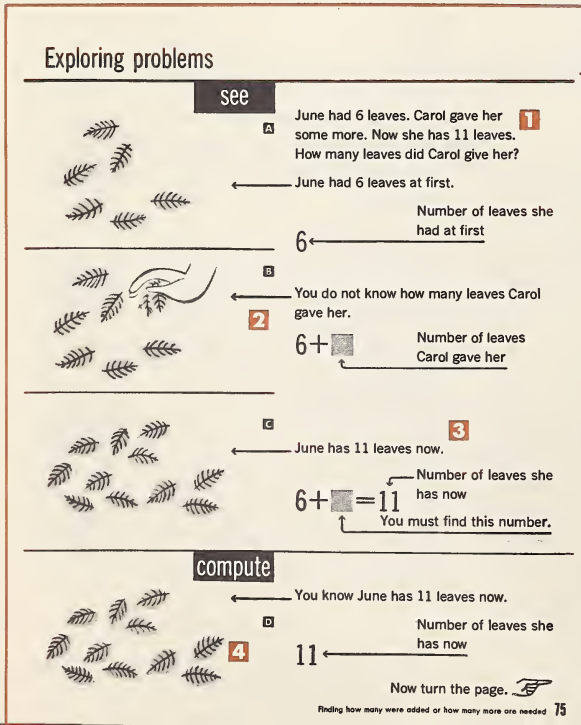
The picture sequence and explanations on pages 75 and 76 should help make the solution of this type of problem meaningful. Two steps are used: "See"—in which pupils either see or imagine the problem situation and action involved and write an equation that has a known number and an unknown number on the left side of the equals sign; "Compute"—in which pupils must imagine some further action taking place to find this unknown number. They must imagine that the group started with is taken away from the final total group to see the number left. This is the quantity that was added or is needed—the answer.

Answers

Exploring problems:

The brackets represent the screen in the equation; the number within them, the answer to be obtained.

A 5+[4]=9	H 4+[3]=7	O 2+3=[5]
B 2+[4]=6	I 7+[2]=9	P 4+[6]=10
C 3+[5]=8	J 4+[3]=7	Q 11−6=[5]
D 6+[4]=10	K 3+[4]=7	R 4+[4]=8
E 5+[5]=10	L 10−7=[3]	S 7+[4]=11
F 2+[6]=8	M 8+[2]=10	T 6+[2]=8
G 3+[6]=9	N 5+[2]=7	


Exploring problems
see
A
June had 6 leaves. Carol gave her some more. Now she has 11 leaves. How many leaves did Carol give her?
1
June had 6 leaves at first.
Number of leaves she had at first
6
B
You do not know how many leaves Carol gave her.
2
6+
Number of leaves Carol gave her
C
June has 11 leaves now.
3
Number of leaves she has now
6+ =11
You must find this number.
compute
You know June has 11 leaves now.
D
Number of leaves she has now
4
11
Now turn the page.
Finding how many were added or how many more are needed
75

75

1 Have pupils read Problem A silently, the aloud. Ask them to read the sentence with th arrow, immediately under the problem, an to look at Picture A and the large numeral Tell them the 6 is the beginning of an equatio

2 Ask them to read the sentence opposite Pictur B and to look at the picture. Explain that t picture shows that Carol gave June some mo leaves. Note that these leaves are put wi the leaves June already had, but that we not know how many Carol gave June. Ask t children if this action makes them think of ad ing or subtracting. Ask them what sign stan for adding. Point out that we use the scre because the number added is not known.

3 Have them look at the sentence with the arr opposite Picture C. Ask what has been writt to complete the equation. Have them read t explanatory material.

4 Have them compare Picture D and the te opposite it.

E ← Think of a group of leaves equal to the leaves June had at first. 1

6 ← Number of leaves June had at first

F ← Imagine that this group of 6 leaves is gone. 2

11
6 ← Subtract 6 from 11.

3
11
6
5 ← Carol gave her 5 leaves.

The number that is left shows how many leaves Carol gave June.

4 6+ =11 ← This number is 5. Carol gave June 5 leaves.

see

A

Jack has 4 cents. A boat he wants to buy costs 10 cents. How many more cents does he need to buy the boat? 5

What does this number stand for?
What does this stand for?
4+ =10
What does this number stand for?

compute

6

How many cents does Jack need in all?
Why do you imagine 4 cents are gone?

B

10
4 ← Subtract 4 from 10.

← Jack needs ▩ more cents.

5

A balloon costs 9¢. Ann has 5¢.
w many more cents does she need
buy the balloon? 1

Number of cents Ann has now.

Number of cents she must add to the money she has.
Number of cents she needs in all.
+ =9
You must find this number.

btract 5 from 9.

Mother had 2 peaches. She bought
ne more. Now she has 6 peaches.
w many peaches did she buy? 1

Number of peaches she had at first.

Number she bought.
Number she has now.
+ =6
You must find this number.

btract 2 from 6.

Don has 3 spools. He needs
ools to make a toy. How many
e spools does he need? 2
▩=8 Subtract 3 from 8.

There were 6 cookies on a plate.
cy put more cookies on it. Then
e were 10 cookies on the plate.
many cookies did Nancy put
he plate?
▩=10 Subtract 6 from 10.

E Ellen wants to draw 10 pictures. She has drawn 5 of them. How many more pictures should she draw?
5+▩=10 Subtract 5 from 10.

F Mother has 2 cups. She needs 8 cups in all. How many more cups does she need?
2+▩=8 Subtract 2 from 8.

G Carol had 3 flowers. Ann gave her some more. Then she had 9 flowers. How many flowers did Ann give her?
3+▩=9 Subtract 3 from 9.

H The children have 4 horns. They need 7 horns in all. How many more horns do they need?

I Carol had 7 toy bears. She got some more for her birthday. Now she has 9 toy bears. How many bears did she get for her birthday?

J Jack needs 7 big blocks. He has 4 blocks. How many more blocks does he need?

K June had 3 dolls. Her mother gave her some more. Now June has 7 dolls. How many dolls did her mother give her?

L The girls made 10 cupcakes. They ate 7 of them. Then they had how many cupcakes? 3

76

1 Have the children read the text at the right of Picture E. Point out that the ring in Picture E shows how many leaves June had at first.

2 Have them read the material at the right of Picture F. Point out that the 6 leaves are dimmed off in the picture because they are to be imagined as taken away. The number of leaves not dimmed off will be those that Carol gave June.

3 Help the children understand that this computation shows the subtraction that was pictured in Picture F.

4 Ask someone to complete this equation.

5 Have the children read this new problem. Point out that more pennies are needed; so more must be added. Have them look at Picture A in answering the questions.

6 Have pupils look at Picture B and the problem statement to answer questions opposite Picture B. Make sure pupils understand why they must subtract.

77

1 Work through Problems A and B with the class. Help them understand what each number in the equation stands for. Use objects if necessary to show the action indicated by the equation and to show why they should subtract.

2 Tell the children to write the letters A to T (M to T are on the next page) on their papers in a column. For each problem, they are to write first the equation with the screen. Then they are to write the statement "Subtract 5 from 9" (or whatever numbers are involved). Finally they are to rewrite the equation with the answer. Each of these written steps will help you see just how well the child understands what he is doing.

3 Be sure the children observe that this is not the same kind of problem, and that the equation is "10—7=▩." Some previously taught problems are included so that children cannot always make the same kind of equation without thinking.

M Bill wants to save 10 cents. He has saved 8 cents. How many more cents does he need to save? **1**

N Don had 5 toy pilots on Monday. On Tuesday he bought more. Then he had 7 toy pilots. How many toy pilots did he buy on Tuesday?

O 2 kittens were in the barn. Tom put 3 more kittens in the barn. How many kittens were in the barn then? **2**

P Tom is going to read 10 pages in a book about dogs. He has read 4 pages. How many more pages does he need to read in this book?

Q Nancy has 6 little dolls and 11 doll dresses. She has how many more doll dresses than dolls? **2**

R Don is making wagons. He needs 8 milk caps for wheels. He has 4 milk caps. How many more milk caps does he need?

S Ellen had 7 pennies in her bank. Mother gave her some more pennies to put in it. Then Ellen had 11 pennies in her bank. How many pennies did Mother give her?

T Betty has 6 hats for her 8 dolls. How many more hats should she make to have a hat for each of her dolls?

Now you should be able to find how many were added or how many more are needed.

Keeping skillful **3**

A 2+□=9	M 2+8=□	A 4+5=□	M 11−2=□
B 3+□=7	N 5+6=□	B 8+□=11	N 5×2=□
C 7+□=10	O 6+3=□	C 7+2=□	O 9÷3=□
D 4+□=9	P 2+5=□	D 6+□=10	P 11−8=□
E 1+□=6	Q 7+4=□	E 8+2=□	Q 4×2=□
F 2+□=11	R 5+4=□	F 1+□=9	R 6÷3=□
G 5+□=10	S 4+6=□	G 3+□=10	S 10−1=□
H 3+□=8	T 2+6=□	H 5+5=□	T 10÷5=□
I 6+□=11	U 4+7=□	I 4+4=□	U 2×3=□
J 8+□=10	V 5+3=□	J 9+□=11	V 11−6=□
K 4+□=8	W 9+2=□	K 4+□=6	W 8÷4=□
L 4+□=11	X 3+8=□	L 7+□=11	X 10÷2=□

78

78

1 Have the children finish solving these problems using procedures described for page 77.

2 Be sure the children know that this problem is not like most of the ones in this lesson. See Note 3 for page 77.

3 The "Keeping skillful" exercise should be handled separately. Exercises A to L (white) are equations resulting from the kind of problem just introduced. Go over them orally with the class. Have the children look at each equation and tell what they would do with it to solve it. Have the children make or write for each equation such a statement as (for A), "Subtract 2 from 9;" then restate or write the equation with the answer. Exercises M to X (white) involve addition basic facts. Exercises A to X (black) in the second set involve both basic facts and equations of the additive-subtraction type. You may have the children copy the letters on their papers and write answers only.

79-82 Moving forward

Expanded Notes for this lesson are on pages 252-253.

Objectives

The child learns the addition and subtraction basic facts for the 13 and 17 groups (the basic facts whose sums and minuends are 13 and 17).

Vocabulary

New words page 79 found*, shells; page 80 altogether; page 81 father*, rest*, yesterday*; page 82 Bob*

Comments

The 13 and 17 groups are introduced before the 12, 14, 15, and 16 groups because these latter groups involve multiplication and division.

As in the previous lesson of this type, this block of work makes use of both real action and imagined action to present the basic facts. Dotted backgrounds, or binders, are used to help children imagine that two groups of pictured objects are combined, although the objects do not actually move together. This imagined action suggests addition. For subtraction, part of a group of pictured objects is dimmed off to help the children imagine that this subgroup is taken away, suggesting subtraction. The device of ringing a group of ten objects is again used so that children can easily see the total number in terms of ten and extra ones.

On page 79, children meet the addition basic facts 4+9=13, 9+4=13, 5+8=13, and 8+5=13 in pictures and in written forms. Page 80 completes, by means of pictures showing imagined action, the addition basic facts. The facts 6+7=13, 7+6=13, 8+9=17, and 9+8=17 are presented. The subtraction basic facts 13−4=9 and 13−8=5 are introduced through pictures showing real action. Page 81 presents, through pictures showing imagined action, the subtraction basic facts 13−7=6, 13−9=4, 13−5=8, and 13−6=7. These facts are also expressed with numerals. Page 82 completes the subtraction basic facts by presenting 17−9=8 and 17−8=9.

Moving forward

On pages 79 to 82 you will learn to add numbers to make 13 and 17. You will also learn to subtract from 13 and 17.

Carol had 4 shells. 2
She found 9 more shells.
How many shells did she have then?

4 + 9 = ■

Tom had 9 shells.
Jack gave him 4 more shells.
How many shells did Tom have then?

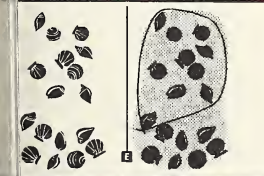
9 + 4 = ■

Betty has 8 shells. 4
Nancy has 5 shells.
How many shells do the two girls have in all?

8 + 5 = ■ 5 + 8 = ■ 7

Ann has 6 shells at home. 1
She has 7 shells at school.
How many shells has she in all?

6 + 7 = ■ 7 + 6 = ■ 3



Don has 9 shells in one box 4
and 8 shells in another box.
He has how many shells altogether in the boxes?

9 + 8 = ■ 8 + 9 = ■

Don found 13 shells.
He gave 4 of them away to another boy.
He has how many shells left?

13 − 4 = ■

Bill had 13 shells at home.
He took 8 of them to school.
How many shells did he leave at home?

13 − 8 = ■

79

1 Ask: "What is happening? How many shells are in the group not being moved? How many shells are being pushed over to them?" Tell children to look at the second scene. Ask: "What has happened? How many shells are there altogether? How can you tell?"

2 Have the children read this problem and the equation silently. They are to use Movie A to check facts given in the problem.

3 Treat this movie and its text in the same way.

4 Have pupils read the text, omitting the equations, and note that the groups are not really put together.

5 In the first scene of Movie C ask them to find Betty's shells, then Nancy's.

6 Ask what the blue dots mean. Let someone tell how to use the ring to find out how many there are in all.

7 Call on someone to read and complete the equations and to explain what each number stands for.

80

1 Have pupils read the problem for Movie D, omitting the equations.

2 Let them identify the shells in the first scene of Movie D. Tell them to use the ring in the second scene to find out how many shells there are in all.

3 Ask them to read and complete these equations and explain why there can be two equations.

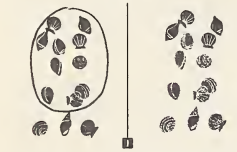
4 Use the procedures of Notes 1 to 3.

5 Have the children look at the first scene of Movie F to find out how many shells there are without counting. Ask what is happening in the second scene. Ask how many of the 13 shells are being removed. Ask how many are left. Have someone state the equation for Movie F. Then have the pupils read the text at the right and compare it with the picture. Ask a pupil to read the problem and equation aloud, saying the missing number.

6 Use the procedures of Note 5 with Movie G.

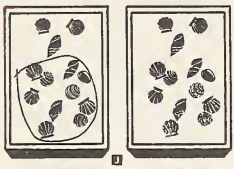
There are 13 shells on the shelf. 1
7 of them are Don's, and the others are Carol's.
How many of them are Carol's?

13 − 7 = ■ 4



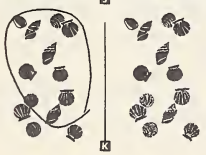
Yesterday Ann and Bill found 13 shells.
Ann found 9 of them, and Bill found the rest.
How many shells did Bill find? 5

13 − 9 = ■



There are 13 shells in a box. 5
5 of them are Jack's, and the others are Tom's.
How many of the shells are Tom's?

13 − 5 = ■



Today Tom's father found 13 shells.
6 shells are for Tom.
The rest are for Nancy. 5
How many shells are for Nancy?

13 − 6 = ■

81

1. Have pupils read the problem for Movie H, omitting the equation.
2. Ask them how many shells are in the first scene of Movie H and how they can tell.
3. In the second scene, ask them to find Don's shells. Ask why they are dimmed off. Ask what this dimming should make them think of. Get the children to understand that 7 shells are to be thought of as being taken away from 13 shells. Ask: "How does the picture show the number of shells left? Are these equal to Carol's shells?"
4. Have pupils read this equation and give the missing number. Help them relate each number to the problem and to the picture.
5. Use Steps 1 to 4 above with this problem and its corresponding movie.

Yesterday Tom's mother found 17 shells.
She will use 9 shells in her garden 1
and the others in a flower box.
How many shells will she use in a flower box?

17 − 9 = ■ 4

There are 17 shells in the box.
8 of them belong to Bob. 5
The rest belong to Betty.
How many shells belong to Betty?

17 − 8 = ■

6

A 17 − 9 = ■
B 4 + 9 = ■
C 13 − 8 = ■
D 9 + 8 = ■
E 8 + 5 = ■
F 13 − 4 = ■
G 7 + 6 = ■
H 6 + 7 = ■
I 13 − 6 = ■
J 5 + 8 = ■
K 13 − 5 = ■
L 9 + 4 = ■
M 8 + 9 = ■
N 17 − 8 = ■
O 13 − 7 = ■
P 13 − 9 = ■

6

A 8 − 5 = ■
B Add 8 to 5.
C 2 × 3 = ■
D Subtract 9 from 13.
E Divide 8 by 4.
F Add 9 to 8.
G Divide 9 by 3.
H Subtract 8 from 13.
I Multiply 4 by 2.
J 9 plus 8 equals ■.
K Subtract 8 from 17.
L Divide 10 by 5.
M Add 7 to 6.
N 13 minus 7 equals ■.
O Multiply 2 by 5.
P Divide 6 by 2.
Q Add 4 to 9.
R Divide 6 by 3.
S Subtract 9 from 17.

Now you should know which numbers to add to make 13 and 17 and how to subtract from 13 and 17.

82

1. Have pupils read the problem for Movie L, omitting the equation.
2. Ask how many shells are in the first scene of Movie L.
3. Ask the children to point to the shells Tom's mother will use in the garden. Have someone tell what the dimming off of these shells suggests. Be sure they know that these 9 are to be thought of as subtracted from all 17.
4. Have pupils read the equation, putting in the missing number on the basis of the information found in the movie.
5. Treat this problem and its movie in the same way as Problem L.
6. Have pupils copy the letters A to P on their papers in a column and in another column the letters A to S. For the first set (A to P) they may write only the answers. For the second set (A to S) they should write equations with answers. In many cases they will have to make the complete equation.

83 Keeping skillful; Checking up

Exponded Notes ore not considered necessary for these lessons.

Objectives

The child reviews and maintains what he has learned about money equivalents and regrouping of tens and ones. His knowledge of the addition and subtraction basic facts for the 11, 13, and 17 groups is tested.

Vocabulary

There are no new words.

Comments

The "Keeping skillful" exercises and the "Checking up" test will give you an opportunity to find out how well children have learned the basic facts and on which ones they need more practice or developmental work.

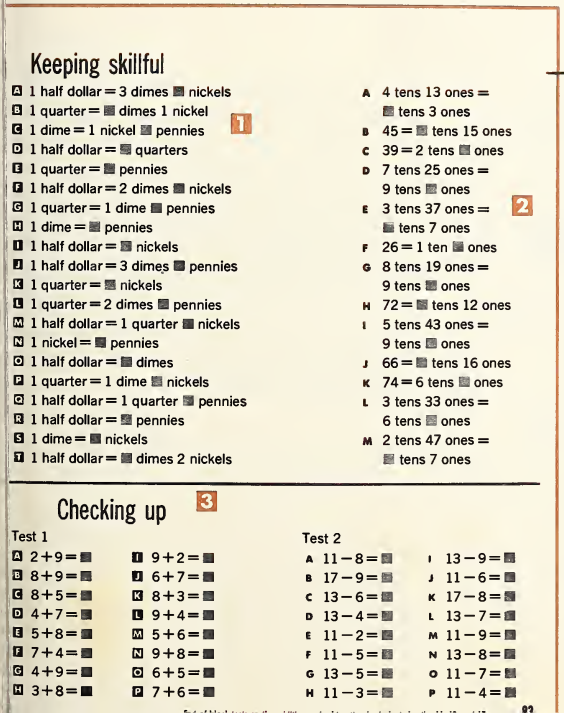
Be sure to go back to the original lessons with those children who reveal weaknesses. Satisfactory work should be correct answers for *all* basic facts. Success in computation requires that the child know all basic facts, not 7 out of 10 or 9 out of 10.

Each child who makes errors should have his own personal list of basic facts that cause him trouble. When a fact ceases to cause trouble, he should cross it out or remove it from his list.

Answers

Keeping skillful:

A 5 tens 3 ones
B 3 tens 15 ones
C 2 tens 19 ones
D 9 tens 5 ones
E 6 tens 7 ones
F 1 ten 16 ones
G 9 tens 9 ones
H 6 tens 12 ones
I 9 tens 3 ones
J 5 tens 16 ones
K 6 tens 14 ones
L 6 tens 3 ones
M 6 tens 7 ones



Keeping skillful

A 1 half dollar = 3 dimes ■ nickels
B 1 quarter = ■ dimes 1 nickel
C 1 dime = 1 nickel ■ pennies
D 1 half dollar = ■ quarters
E 1 quarter = ■ pennies
F 1 half dollar = 2 dimes ■ nickels
G 1 quarter = 1 dime ■ pennies
H 1 dime = ■ pennies
I 1 half dollar = ■ nickels
J 1 half dollar = 3 dimes ■ pennies
K 1 quarter = ■ nickels
L 1 quarter = 2 dimes ■ pennies
M 1 half dollar = 1 quarter ■ nickels
N 1 nickel = ■ pennies
O 1 half dollar = ■ dimes
P 1 quarter = 1 dime ■ nickels
Q 1 half dollar = 1 quarter ■ pennies
R 1 half dollar = ■ pennies
S 1 dime = ■ nickels
T 1 half dollar = ■ dimes 2 nickels

1

A 4 tens 13 ones = ■ tens 3 ones
B 45 = ■ tens 15 ones
C 39 = 2 tens ■ ones
D 7 tens 25 ones = 9 tens ■ ones
E 3 tens 37 ones = ■ tens 7 ones
F 26 = 1 ten ■ ones
G 8 tens 19 ones = 9 tens ■ ones
H 72 = ■ tens 12 ones
I 5 tens 43 ones = 9 tens ■ ones
J 66 = ■ tens 16 ones
K 74 = 6 tens ■ ones
L 3 tens 33 ones = 6 tens ■ ones
M 2 tens 47 ones = ■ tens 7 ones

2

Checking up

3

Test 1

A 2+9=■
B 8+9=■
C 8+5=■
D 4+7=■
E 5+8=■
F 7+4=■
G 4+9=■
H 3+8=■
I 9+2=■
J 6+7=■
K 8+3=■
L 9+4=■
M 5+6=■
N 9+8=■
O 6+5=■
P 7+6=■

Test 2

A 11−8=■
B 17−9=■
C 13−6=■
D 13−4=■
E 11−2=■
F 11−5=■
G 13−5=■
H 11−3=■
I 13−9=■
J 11−6=■
K 17−8=■
L 13−7=■
M 11−9=■
N 13−8=■
O 11−7=■
P 11−4=■

83

83

1 Have the children write only the answers. If a child has trouble with these exercises, instruct him to draw coins on his paper for each exercise, to label each coin with its money value, and to write below it the numbers he would say in counting the amount.

2 Have the children write answers only.

3 The children may write only the answers to these two tests.

84-85 Using arithmetic

Expanded Notes for this lesson are on pages 253-254.

Objectives

The child practices solving all the types of problems presented so far.

Vocabulary

New words page 84 stones; page 85 pieces, spend, way*

Comments

The set of problems on these pages is a good test of the children's ability to interpret verbal problems. All types of problems studied so far—those based on simple additive, subtractive, multiplicative, and divisive situations, those involving a comparison (how many more than or fewer than), and those concerned with finding how many more are needed or were added—are presented. Require each child first to write the equation with a screen and then with the answer.

The "Thinking straight" exercises on page 85 introduce a new type of exercise designed to help children develop common sense in using arithmetic. The problems are meant primarily for discussion.

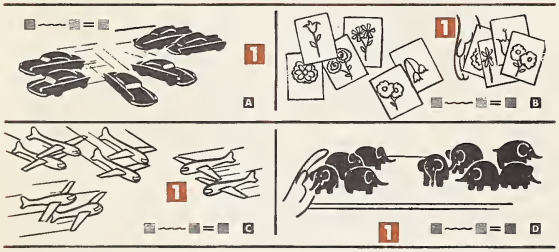
Answers

Using arithmetic:

A 10−2=[8]	G 8−3=[5]	M 13−9=[4]
B 8+[2]=10	H 2×5=[10]	N 10−6=[4]
C 9−4=[5]	I 4−2=[2]	O 8+5=[13]
D 4+4=[8]	J 8+[5]=13	P 11−2=[9]
E 10÷2=[5]	K 3×3=[9]	
F 7+2=[9]	L 11−8=[3]	

Page 85: Allow for a discussion of all possible viewpoints for the answers to Problems B and D. Point out that no one "right" answer is possible. For B, Jane would get more candy in the two suckers at 5¢ each. On the other hand, she might want to share the suckers with two friends of hers. Then she would want to buy the 3 suckers for 10¢. For D, Ellen can make a good saving in buying these peaches at 1¢, but if she bought 25 peaches, they might spoil before she could eat them all. Five peaches would probably be a good buy.

Using arithmetic



A There were 10 toy policemen in a box in the store. Tom bought 2 of them. Then how many toy policemen were in the box?

B Don's bird book has 10 pages. Don wants to put a bird picture on each page. He now has 8 pictures in the book. How many more pictures does he need?

C Jack has nine problems to do. Bill has four problems to do. Bill has how many fewer problems to do than Jack?

D Ellen has 4 books about flowers, and Betty has 4 books about flowers. The girls have how many books about flowers altogether?

E Don wants to put ten shells into groups of two shells each. How many groups will he have?

F Bob found 7 stones on Saturday and 2 stones on Monday. How many stones did he find on these two days?

G Ann has 8 small dolls. She has 3 doll dresses. She has how many more dolls than doll dresses?

H 2 groups of boys were playing ball. There were 5 boys in each group. How many boys were playing ball?

I Bill has 4 books about boats. He has 2 books about airplanes. He has how many more books about boats than about airplanes?

84

1 Have the children look at these pictures and determine for each one from the action whether it suggests addition, subtraction, multiplication, or division and why. Be sure they note the equality of groups in Pictures A and C. Then have them give the equation for each picture, with the answer.

2 Have the children first solve these problems (continued on the next page) on paper without help. For each problem they are to write the equation with the screen. Then write the equation with the answer.

J Tom has 8 cents. He wants to buy a toy policeman that costs 13 cents. How many more cents does he need to buy the toy policeman? 1

K On Monday 3 groups of girls worked in the school garden. There were 3 girls in each group. How many girls worked in the garden that day?

L On Tuesday 11 boys and 8 girls worked in the school garden. How many more boys than girls worked in the garden that day?

M Bill found 13 stones on his way home, and Jack found 9. Jack found how many fewer stones than Bill?

N Jack spent 10 cents, and Tom spent 6 cents. Jack spent how much more money than Tom?

O Bill had 8 toy firemen. His father gave him 5 more. Then Bill had how many toy firemen?

P Tom had 11 horses for his toy barnyard. He gave 2 of them to Bill. Then Tom had how many horses? 2

Thinking straight

A

B

C

A How much does the candy in Picture A cost? How much does the candy in Picture B cost? 3

B June has 10 cents to spend. Should she buy 2 pieces of the candy in Picture A, or should she buy 3 pieces of the candy in Picture B? Why? 4

C Each day Ellen buys a peach that costs 2 cents. How much does one of the peaches cost today? Picture C shows you. 5

D Today Ellen has 25 cents. Should she buy 1 peach, 5 peaches, or 25 peaches? Why? 6

85

85

1 Have the children first solve these problems on paper without help. For each problem they are to write the equation with the screen. Then write the equation with the answer.

2 After the children conclude this problem set, go over the work orally in class. Use objects, if necessary, to help slow children understand and visualize the problems.

3 Treat the "Thinking straight" exercises as a separate activity to be done orally. Have the children read Problem A and use Pictures A and B to get answers. Permit extensive discussion and encourage their suggesting other similar situations.

4 Problem B should cause much discussion. Let everyone have an opportunity to air his views, since there is no one right answer.

5 Have the children read Problem C and use Picture C to get the answer.

6 Problem D and its possible solutions should be discussed thoroughly.

86-91 Moving forward

Exponded Notes for this lesson are on pages 254-257.

Objectives

The child becomes acquainted with the standard units of inch, foot, and yard for linear measurement and the standard units of pint, quart, and gallon for capacity measurement. He learns the equivalents of linear and capacity measures.

Vocabulary

New words page 86 gallons, lesson, measure; page 88 schoolroom*, things*, wide*; page 91 fence*, high*, hold*, picnic, tall*

Old words page 86 feet*, inches, pints, quarts; page 87 foot*; page 88 long*; page 91 bottle, less

Comments

The pictures in this lesson may be used to introduce basic measuring concepts to children. But to help children make use of these concepts, you will want to supplement the work on these pages with many experiences in measuring real things in the units introduced. Only by *measuring* can children learn to measure. This means that you will need to collect pint, quart, and gallon containers or have children bring them from home. Objects for linear measurement can be found around the schoolroom. If possible, try to see that every child has his own foot ruler, or help him make one. Do not stress the fractional inch markings on the ruler. These are developed in *Book 4* along with fractions.

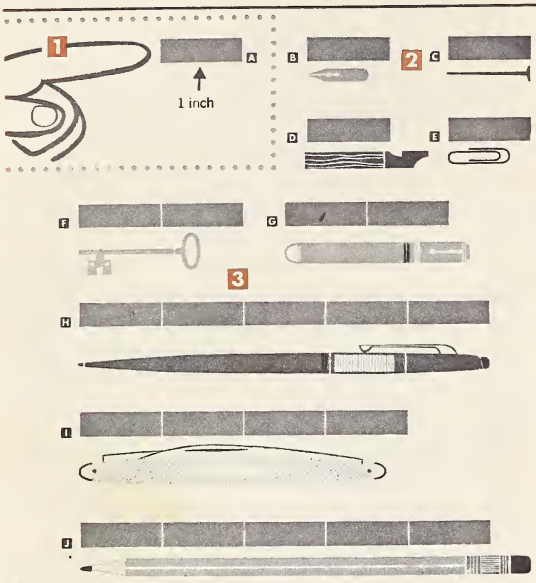
One difficulty in presenting measurement in pictures is that of varying scale in the pictures. To help the child visualize relative sizes, the finger is used with the inch on page 86 and the hand with the foot on page 87. The boy in the pictures on page 89 and the hand on page 90 serve the same purpose.

Answers

Page 91: A 8+3=[11]; B 11−8=[3]; C 2+3=[5] or 3+2=[5]; D more; E less; F less; G Carol's; H June; I 1 yard; J less; K 8 pints; L more; M more; N 1 gallon; O more

Moving forward

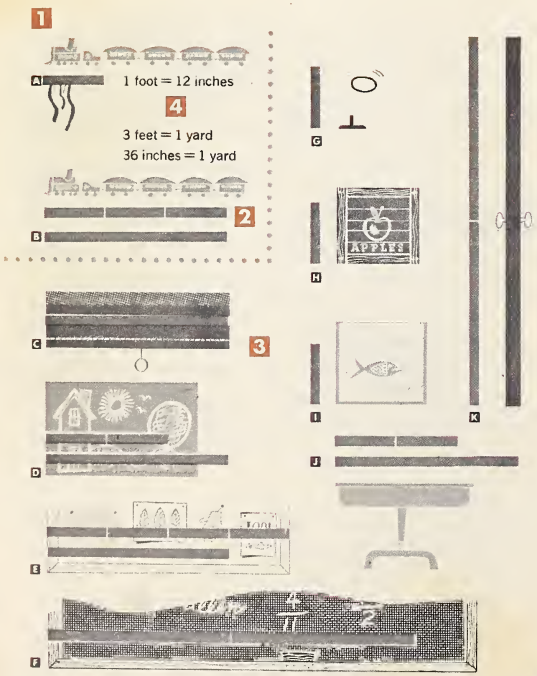
In this lesson you will learn how to measure, using inches, feet, yards, pints, quarts, and gallons.



86 Measurement, linear and liquid; equivalents

86

1. Start with a discussion about the fact that it is impossible for people to talk to one another about measurements unless they use the same measuring units. Then give each child a 1-inch stick or cardboard and tell him its length. Ask pupils to place this stick over the stick to which the finger is pointing in the book.
2. Ask children how long the objects pictured in B to E are. Show them how to use the yellow strips, which are 1 inch long. Allow such answers as "not an inch long," "about an inch," "shorter than an inch," etc. They may use their sticks to check the pictured inches.
3. For the remaining items pictured (F to J), help the children see that the 1-inch measuring sticks are laid end to end. Ask them to tell approximately how long each of the items is. Work for proper expressions. Let the children measure other small objects in the room with the 1-inch stick or cardboard. Let children combine sticks to measure longer objects.

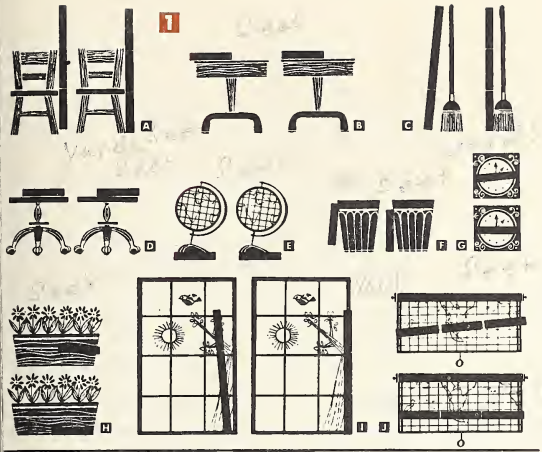


78

87

87

1. Before having children work with Picture A, let each child have an opportunity to handle a foot ruler and to note the 12 inches that are marked off on it. Then call their attention to the hand holding the ruler in the picture. Have them compare its size with the finger on the preceding page. Then ask them how long they think the train is.
2. Have them look at this picture and tell how long the train is. Place a yardstick on a table or desk and ask three children to lay their rulers end to end to find that 3 feet equal 1 yard. Then ask for the train's length in terms of yards. Explain that some of the yellow strips on this page stand for feet and some for yards. Let them show some of each.
3. Have the children tell the approximate measurements of each object (C to K). Help them see that sometimes it is best to measure in feet, at other times in yards.
4. Have children read this table of equivalents.



A Look at the pictures. Would you measure each of these things in inches, feet, or yards?

B In your schoolroom find as many of these things as you can. About how long or how wide do you think each of them is?

C Measure each thing you found. How long or how wide was it?

88

1 For Pictures A to J have the children decide which is the correct way to measure. Discuss these questions about measuring: "Is the measuring instrument lined up with the edge of the object being measured? Is the measuring instrument placed straight up and down or across the object being measured? When several measuring instruments are laid end to end properly, are there any spaces between them?"

2 First let the children name these objects and locate them in the schoolroom or school building. Then have them take turns answering Question A for each object. Now let each child write in a column on his paper the name of each object and opposite it his estimate of its length or width. Let them use such expressions as "2 feet," "almost 1 foot," "a little more than 3 feet." Finally, have the children verify their estimates by measuring. They may work in groups, or you may select one or two children to do the measuring.

89

1 Tell the children that each of these containers holds a pint. If possible, have some similar containers in the room. Let the children fill one container, then transfer the contents to another pint container, thus learning that differently shaped containers may hold a pint. Use dried beans, corn, or some other suitable material for measuring.

2 Tell the children that each of these containers holds a quart. Have them work with actual quart containers, as suggested above for pints.

3 Tell children that each of these containers holds a gallon. Again, let them work with actual gallon containers.

4 Let the children decide, by comparison with the containers in Pictures A to C, the approximate capacity of each container in Pictures D to O. Tell them that the correct answer may be "I can't tell." Help children recognize that there are situations in which the capacity of a container cannot be determined visually.

90

90

1 Tell the pupils that the two different-sized containers in the first picture are pint and quart containers. Get them to note that it takes 2 pints to make 1 quart. Be sure to let them experiment with real containers.

2 Have pupils identify these containers as quart and gallon containers. By following the movie, they can see that it takes 4 quarts to make 1 gallon. If possible, let them experiment with real containers.

3 Here the children should note that it took 8 pints to fill the gallon container. Allow one of the pupils to see how many times he has to fill a pint container and empty it into a gallon container to fill the gallon container.

1

A 12 inches = 1 ⁓
B 3 feet = 1 ⁓
C 1 quart = ▒ pints
D 1 gallon = 8 ⁓
E 1 yard = ▒ feet
F 1 gallon = ▒ quarts
G 1 yard = 36 ⁓
H 1 gallon = 4 ⁓
I 1 quart = 2 ⁓
J 8 pints = 1 ⁓
K 1 foot = 12 ⁓
L 36 inches = 1 ⁓

2

A Mother had 8 pints of milk on one shelf and 3 pints of milk on another shelf. Mother had how many pints of milk altogether?

B A tree in Jack's yard is 11 feet tall. A tree in Don's yard is 8 feet tall. The tree in Jack's yard is how much taller than the tree in Don's yard?

C May took 2 quarts of milk to a picnic. Ellen took 3 quarts of milk. How many quarts in all did the girls take to the picnic?

D A toy barn is 15 inches wide. Is it more than 1 foot wide or less than 1 foot wide?

E A table is 30 inches high. Is it more than 1 yard high or less than 1 yard high?

F Will 1 gallon bottle hold more milk or less milk than 5 quart bottles?

G Ann has a doll that is 1 foot tall. Carol has a doll that is 14 inches tall. Which girl's doll is taller?

H June bought 1 gallon of milk. Ellen bought 3 quarts of milk. Which girl bought more milk?

I Carol measured a dollhouse. It was 3 feet wide. How many yards wide was it?

J A hammer is 9 inches long. Is it less than 1 foot long or more than 1 foot long?

K Ellen's mother used 1 gallon of milk in 3 days. How many pints of milk did she use?

L A box is 4 feet long. Is it more than 1 yard long or less than 1 yard long?

M A garden fence is 39 inches high. Is it more than 1 yard high or less than 1 yard high?

N One day Ann's mother used 4 quarts of milk. How many gallons of milk did she use that day?

O Will 3 pint bottles hold more milk or less milk than 1 quart bottle?

Now you should be able to measure, using inches, feet, yards, pints, quarts, and gallons.

91

1 First you may ask the children to respond orally. Then they may respond in writing. Have them write the answers opposite the identifying letters on their papers. The exercises with wavy lines require measurement words for their completion. The screens should be replaced with numbers.

2 For these problems also have the children write the answers opposite the labeling letters. Have them write the words and numbers that answer the questions. Exercises D to O have been designed to give the children an opportunity to apply their knowledge of measurement equivalents and to use judgment in doing so.

92-93 Exploring problems

Expanded Notes for these lessons are on pages 257-258.

Objectives

The child learns to solve problems in which the number of items bought, the number of boxes needed, etc., is the same as the number of equal groups he finds.

Vocabulary

New words page 92 because*, so*; page 93 answer*, peanuts

Old words page 92 sticks*

Comments

The division exercises in "Exploring problems" are the same type that children have previously studied—finding the number of equal groups—and they are solved in the same way. One important difference, however, is that the answer must be expressed in terms that are different from what the computation suggests. For example, a problem may be solved by dividing to find how many groups of 2 pennies there are, but the answer must be described as candy sticks that can be bought, not as groups of 2 pennies. Before the child can arrive at the answer, he must establish a one-to-one correspondence between the number of groups found and the number of objects to be expressed in the answer. In other words, he must understand that the number of items (boxes, bags, apples, etc.) is the same as the number of groups into which he divides the money or objects mentioned in the problem. This translation from groups to objects, which in the past has usually been overlooked, is made clear by the problems, pictures, and explanations in this lesson.

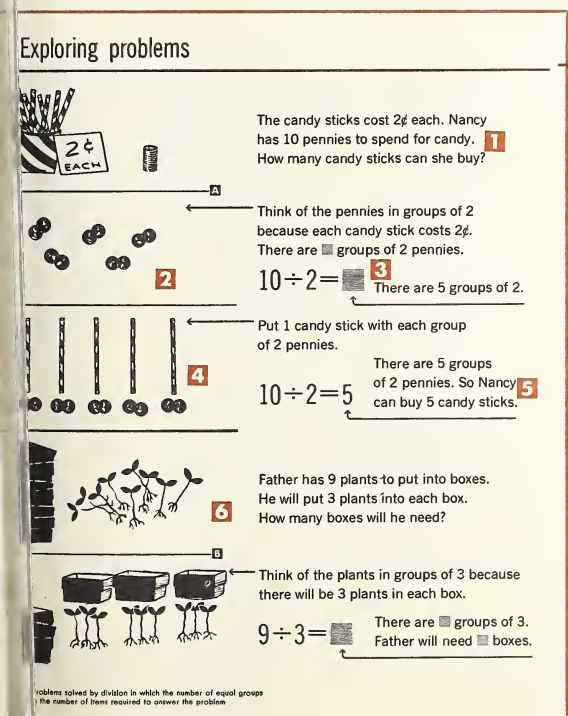
The "Keeping skillful" exercises help maintain the basic facts for the four processes and provide practice with equations in which the missing number is on the left side of the equals sign.

Answers

Exploring problems:

E $6 \div 2 = [3]$ G $4 \div 2 = [2]$ I $8 \div 4 = [2]$

F $8 \div 2 = [4]$ H $6 \div 3 = [2]$


Exploring problems
2¢ EACH
The candy sticks cost 2¢ each. Nancy has 10 pennies to spend for candy. 1 How many candy sticks can she buy?
A
Think of the pennies in groups of 2 because each candy stick costs 2¢. There are ■ groups of 2 pennies.
2
10÷2=■ 3
There are 5 groups of 2.
Put 1 candy stick with each group of 2 pennies.
4
There are 5 groups of 2 pennies. So Nancy can buy 5 candy sticks. 5
10÷2=5
Father has 9 plants to put into boxes. He will put 3 plants into each box. How many boxes will he need?
6
B
Think of the plants in groups of 3 because there will be 3 plants in each box.
There are ■ groups of 3. Father will need ■ boxes.
9÷3=■
oblems solved by division in which the number of equal groups
the number of items required to answer the problem

92

1 Have the children read this problem and relate it to the objects in the first scene of Movie A.

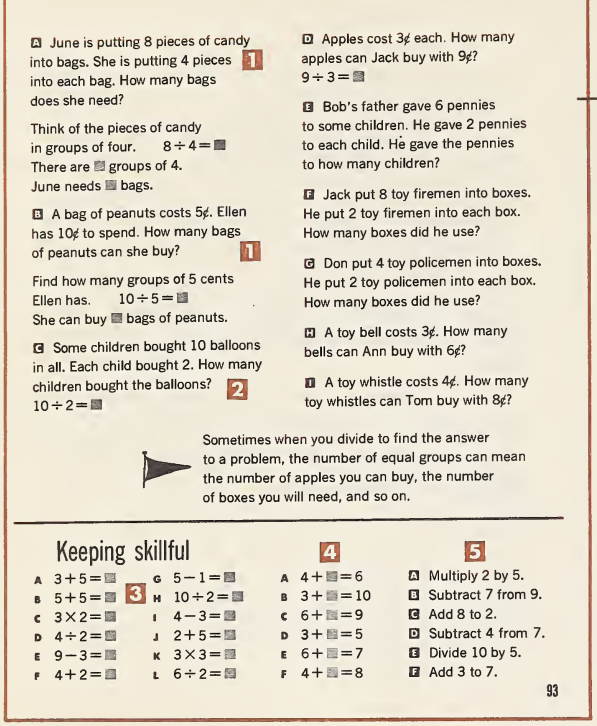
2 Direct attention to the second scene and let the children discover that the pennies have been grouped in twos because each candy stick costs 2¢. Have the statements opposite the picture read aloud.

3 Explain that if the picture were not there to show the 5 groups of 2 pennies, the answer could be found by dividing 10 by 2. Then have the children look at the equation.

4 Direct attention to the third scene. Have someone explain why there is one candy stick for each group of two pennies. Ask how many candy sticks there are in all.

5 Explain that instead of putting a candy stick with each group of 2 pennies, as in the picture, we can imagine 1 candy stick put with each of the 5 groups. Now direct attention to the equation.

6 Treat this problem and movie in the same way.



A June is putting 8 pieces of candy into bags. She is putting 4 pieces into each bag. How many bags does she need? 1

Think of the pieces of candy in groups of four. $8 \div 4 = \square$
There are ■ groups of 4.
June needs ■ bags.

B A bag of peanuts costs 5¢. Ellen has 10¢ to spend. How many bags of peanuts can she buy? 1

Find how many groups of 5 cents Ellen has. $10 \div 5 = \square$
She can buy ■ bags of peanuts.

C Some children bought 10 balloons in all. Each child bought 2. How many children bought the balloons? 2
$10 \div 2 = \square$

D Apples cost 3¢ each. How many apples can Jack buy with 9¢?
$9 \div 3 = \square$

E Bob's father gave 6 pennies to some children. He gave 2 pennies to each child. He gave the pennies to how many children?

F Jack put 8 toy firemen into boxes. He put 2 toy firemen into each box. How many boxes did he use?

G Don put 4 toy policemen into boxes. He put 2 toy policemen into each box. How many boxes did he use?

H A toy bell costs 3¢. How many bells can Ann buy with 6¢?

I A toy whistle costs 4¢. How many toy whistles can Tom buy with 8¢?

Sometimes when you divide to find the answer to a problem, the number of equal groups can mean the number of apples you can buy, the number of boxes you will need, and so on.

Keeping skillful

3

A $3+5=\square$	G $5-1=\square$	A $4+\square=6$	A Multiply 2 by 5.
B $5+5=\square$	H $10 \div 2=\square$	B $3+\square=10$	B Subtract 7 from 9.
C $3 \times 2=\square$	I $4-3=\square$	C $6+\square=9$	C Add 8 to 2.
D $4 \div 2=\square$	J $2+5=\square$	D $3+\square=5$	D Subtract 4 from 7.
E $9-3=\square$	K $3 \times 3=\square$	E $6+\square=7$	E Divide 10 by 5.
F $4+2=\square$	L $6 \div 2=\square$	F $4+\square=8$	F Add 3 to 7.

4 5

93

93

1 Discuss this problem with the children. Take special care to see that the answer is given in the same terms as the question asked in the problem. Note that the equation is given.

2 The children should work independently on Problems C to I. For C and D they should write the equation with the answer. For the remaining problems they should first write the equation with the screen and then with the answer.

3 Handle the "Keeping skillful" exercises as a separate activity. The children may copy the letters A to L on their papers and write only the answers.

4 For these exercises have the children copy the letters, do the computation, and then write the equations with their answers in the proper places.

5 The children may write only the answers to these exercises, or they may write an equation for each one, supplying the answers.

94-102 Moving forward

Expanded Notes for this lesson are on pages 258-261.

Objectives

The child learns the basic facts for all four processes for the 12 group (the basic facts whose sums, minuends, products, and dividends are 12).

Vocabulary

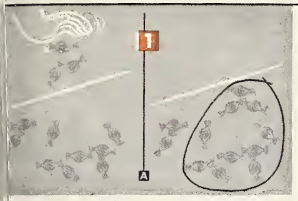
New words page 96 popcorn; page 97 lunch*; page 101 butterflies*, vases
Old words page 99 flying*

Comments

As in previous work with basic facts beyond the 10 group, the pictures in this lesson illustrate both real and imagined action. The dotted backgrounds in the pictures (see Picture D, page 95) are intended to help children imagine that two groups of objects that do not actually join are combined. The dimming off of part of a group of pictured objects that do not actually move apart (Picture D, page 96) helps children to imagine that a subgroup is being removed or is not there. To help children think of multiplication when no real action takes place, a dotted background is used to indicate the combining of equal groups (Movie B, page 98). For divisive situations in which no real action takes place, the circling of equal groups within the total group indicates the imagined separation (Movie B, page 100). Throughout this lesson a ring is used around 10 to help the children identify 12 quickly.

Moving forward

On pages 94 to 102 you will find out how to add and multiply to make 12. You will also learn how to subtract from 12 and how to divide 12.

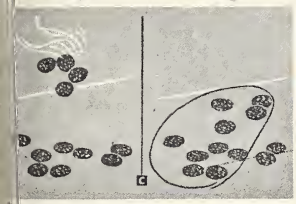


9 pieces of candy were on the table.
Ellen put 3 more pieces on the table. 2
Then there were ■ pieces of candy on the table.

9 + 3 = ■

7 cupcakes were in the box.
Carol put 5 more cupcakes into the box.
Then there were ■ cupcakes in the box.

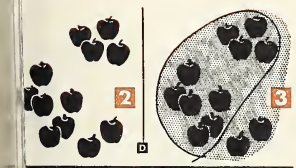
7 + 5 = ■



8 cookies were on the table.
Mother put 4 more cookies on the table.
Then there were ■ cookies on the table.

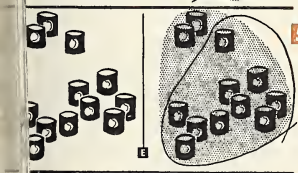
8 + 4 = ■

e addition, subtraction, multiplication, and division basic facts for the 12 group



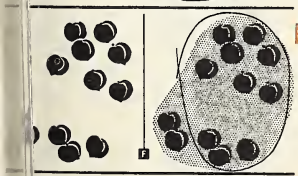
Nancy has 4 apples. 1
Ellen has 8 apples.
The girls have how many apples altogether?

4 + 8 = ■ 8 + 4 = ■ 4



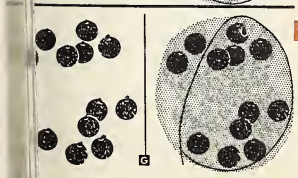
5 3 small cans of peaches were on one shelf.
9 small cans of peaches were on another shelf.
There were ■ small cans of peaches in all.

3 + 9 = ■ 9 + 3 = ■



5 Ann's mother used 7 peaches for a shortcake.
Carol's mother used 5 peaches for her shortcake.
How many peaches in all did the mothers use?

7 + 5 = ■ 5 + 7 = ■



5 May's mother bought 6 oranges.
Betty's mother also bought 6 oranges.
The two mothers bought ■ oranges in all.

6 + 6 = ■

94

1 For the first scene of Movie A, get the children to notice the number of pieces of candy on the table and the number being put with the original group. In the second scene they should observe that the ring encloses 10 pieces, which makes it easy to determine the size of the total group as 12.

2 The children may read this problem and the equation silently. Tell them to see if the movie illustrates what is happening in the problem. Examination of the second scene of Movie A will help in finding the missing numbers in the problem and equation. Call on a pupil to read the entire problem and equation aloud, saying the missing numbers.

3 Treat this movie and problem in the same way.

95

1 Direct pupils to read these 4 lines (omitting the equations).

2 Ask them to look at this movie and find first Nancy's apples, then Ellen's apples.

3 Explain that the background helps them think of the groups of 4 apples and 8 apples as combined. Call on someone to tell how many apples there are in all when the two groups are thought of as one group. Ask someone to explain how the ring helps in determining the size of the total group.

4 Have pupils read these two equations, saying the missing numbers. Explain why both equations describe the movie [because either group can be imagined as joining the other].

5 Adapt Notes 1 to 4 to this problem and its movie.

12 apples were on the shelf.
Now a man is putting 8 of them into a basket.
■ apples will be left on the shelf.

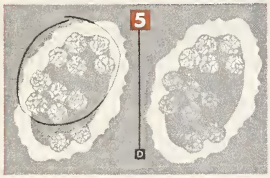
12 − 8 = ■

12 oranges were on the shelf.
Mother is buying 5 of them.
How many oranges will be left on the shelf?

12 − 5 = ■

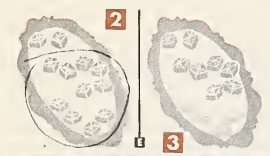
12 peaches were on the table.
Mother is buying 3 of them.
Then ■ peaches will be left on the table.

12 − 3 = ■



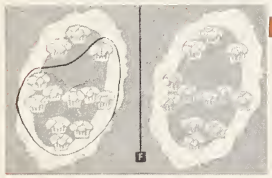
There are 12 popcorn balls on the tray.
Nancy made 7 of them.
She bought the rest.
How many popcorn balls did she buy?

12 − 7 = ■



12 pieces of candy are on the tray.
4 of the pieces are for Tom.
The rest are for Ellen.
■ pieces of candy are for Ellen.

12 − 4 = ■



Mother put 12 cupcakes on a tray.
She took 9 of them from a box.
She took the others from a bag.
How many did she take from the bag?

12 − 9 = ■

12 cookies are on the tray.
Mother made 6 of them for lunch.
Ann made the others.
Ann made ■ cookies.

12 − 6 = ■

A 3+9=■	I 12−4=■	A 2+7=■	I Add 9 to 3.
B 12−5=■	J 6+6=■	B 10−7=■	J Subtract 4 from 12.
C 12−8=■	K 12−9=■	C 9+8=■	K Subtract 6 from 12.
D 4+8=■	L 12−7=■	D 13−9=■	L Add 5 to 7.
E 12−6=■	M 8+4=■	E 2+3=■	M Add 6 to 5.
F 7+5=■	N 12−3=■	F 17−9=■	N Subtract 3 from 12.
G 9+3=■	O 5+7=■	G 8−5=■	O Add 4 to 8.
H 12−7=■	P 4+8=■	H 5+6=■	P Subtract 2 from 11.

96

1 Have someone tell, without counting, how many apples there are in the first scene. Ask what is happening in the second scene.

2 Have pupils read the problem to themselves and look at Picture A to "see" the action described. Be sure they can identify the total group, the group removed, and the result. Then have someone read the problem and equation aloud, saying the missing numbers.

3 Use the same procedures with this movie and its accompanying text.

4 Ask pupils to read the problem for Movie D but not the equation.

5 Ask how many popcorn balls are shown in the first scene. Explain what the dimming off of the 7 popcorn balls in the second scene means. Ask someone how many are not dimmed off and get the class to tell how many popcorn balls will be left if the 7 dimmed-off ones are thought of as gone.

6 Have the equation read with the answer.

97

1 Have pupils read the problem for Movie E but not the equation.

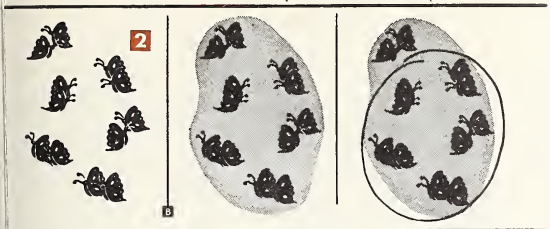
2 Ask pupils how they can tell, without counting, how many pieces of candy the first scene of Movie E shows.

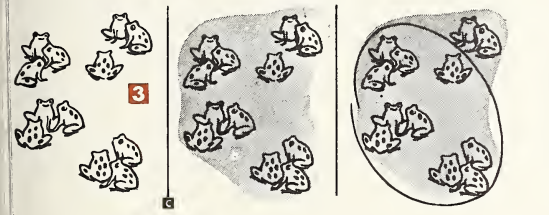
3 For the second scene, get the children to discover that the 4 dimmed-off pieces are for Tom (the pieces imagined as gone). Similarly, the undimmed pieces must be Ellen's. Have someone tell how many pieces will be left when the 4 dimmed pieces are imagined as gone.

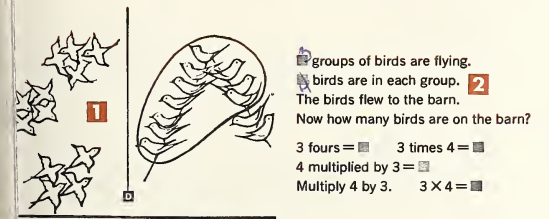
4 Have a pupil read the last line of the problem supplying the missing number. Have another pupil read the equation, supplying the missing number.

5 Use Notes 1 to 4 with this problem and its movie.

6 This set of exercises may be done orally, then used as written work.

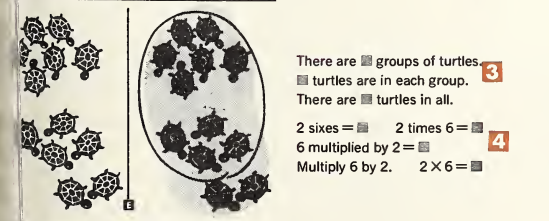






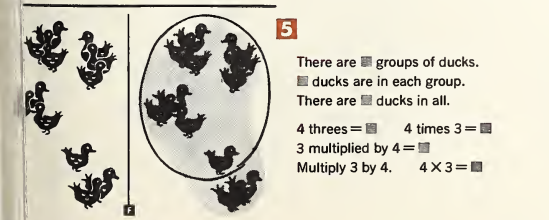
groups of birds are flying.
birds are in each group. 2
The birds flew to the barn.
Now how many birds are on the barn?

4 fours = ■ 3 times 4 = ■
4 multiplied by 3 = ■
Multiply 4 by 3. 3 × 4 = ■



There are ■ groups of turtles. 3
■ turtles are in each group.
There are ■ turtles in all.

2 sixes = ■ 2 times 6 = ■
6 multiplied by 2 = ■ 4
Multiply 6 by 2. 2 × 6 = ■



5

There are ■ groups of ducks.
■ ducks are in each group.
There are ■ ducks in all.

4 threes = ■ 4 times 3 = ■
3 multiplied by 4 = ■
Multiply 3 by 4. 4 × 3 = ■

98

1 Draw attention to the first scene of Movie A. Ask the children how many birds are in each group and how many groups of birds there are. Get them to note that the groups are equal. Ask what is happening in the second scene and have the children explain why they think of this as a multiplicative situation. For the third scene, have the pupils state what happened and give the answer.

2 For Movie B ask how many butterflies are in each group and how many groups there are in the first scene. For the second scene explain that the dotted background shows that we are to imagine the butterflies as one group. Get a pupil to explain how the ring in the third scene helps to tell how many there are in all and give the answer.

3 Use Note 2 for this movie.

99

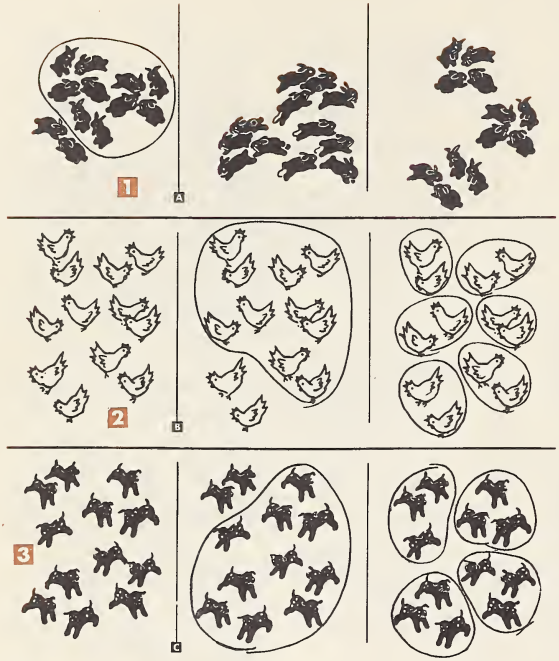
1 Ask a pupil to tell how many birds are in each group and how many groups there are in the first scene. Ask another pupil what has happened in the second scene and to tell how many birds are on the roof. Ask someone to read the equation for the movie.

2 Pupils should use Movie D to find the missing numbers and the answer to the question. Make sure they understand that the multiplication expressions under the problem are different ways of expressing what is happening in the movie.

3 Have pupils read these three lines. Tell them to look at Movie E to find the missing numbers.

4 Remind pupils that these are different ways of telling what happened in Movie E. Pupils may take turns reading the lines, supplying the missing numbers.

5 Use Notes 3 and 4.



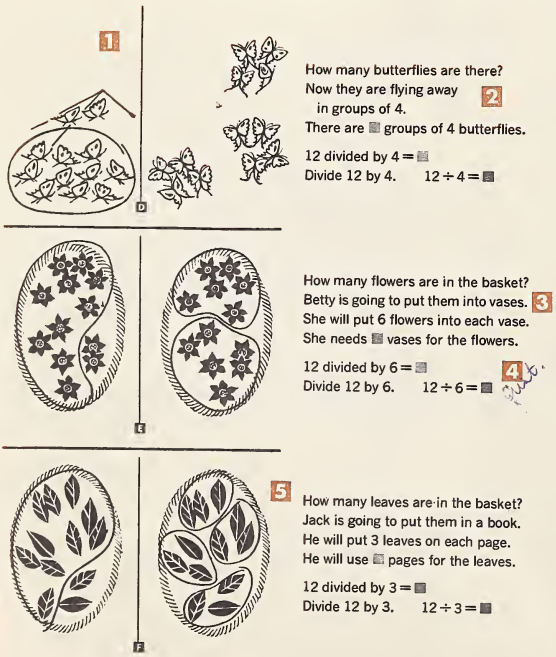
100

100

1 Let the children determine, in Movie A, how many rabbits there are in all, how many are in each group hopping away, and, finally, how many groups there are. Stress the equality of the groups.

2 In Movie B the chickens are not moving. Get pupils to observe this. Encourage them to discover the number in the total group (using the ring to find 10), the number in each group (determined by the ring around each group of 2), and, finally, the number of groups.

3 Use Note 2 for this movie.


1
D
How many butterflies are there?
Now they are flying away 2
in groups of 4.
There are ■ groups of 4 butterflies.
12 divided by 4 = ■
Divide 12 by 4. 12 ÷ 4 = ■
E
How many flowers are in the basket?
Betty is going to put them into vases. 3
She will put 6 flowers into each vase.
She needs ■ vases for the flowers.
12 divided by 6 = ■
Divide 12 by 6. 12 ÷ 6 = ■ 4
F
5
How many leaves are in the basket?
Jack is going to put them in a book.
He will put 3 leaves on each page.
He will use ■ pages for the leaves.
12 divided by 3 = ■
Divide 12 by 3. 12 ÷ 3 = ■

101

1 In the first scene pupils should discover the size of the total group. In the second scene have them determine the size of each group and decide that the groups are equal. Get them to describe the separating action in terms of division. Then have someone read the equation that describes the movie.

2 Have the children use Movie D to answer the question and find the missing numbers. Make sure they understand that the three expressions describe what is happening in the movie.

3 Have pupils answer the first question by referring to the first scene of Movie E. Have them read the rest of the problem and relate the 6 flowers to the 6 flowers inside each ring in the second scene. Ask how many groups there are. Have a pupil reread the last line of the problem, saying the missing number.

4 Have pupils read these different ways of stating what the movie shows.

5 Treat this problem and movie in the same way.

1

A 12−8=
B 4×3=
C 6+6=
D 12−3=
E 12−7=
F 9+3=
G 12÷4=
H 4+8=
I 6×2=
J 12−5=
K 12÷2=
L 5+7=
M 12÷6=
N 12−9=
O 8+4=
P 2×6=
Q 3+9=
R 12−4=
S 12÷3=
T 7+5=
U 12−6=
V 3×4=

2

A 17−9=
B 3+8=
C 13−5=
D 12÷2=
E 4+7=
F 9+8=
G 12−9=
H 11−6=
I 8+9=
J 6+7=
K 13−4=
L 5+8=
M 17−8=
N 6×2=
O 13−6=
P 4+9=
Q 11−5=
R 8+5=
S 9+3=
T 3×4=
U 13−7=
V 6+6=

3 Now you should know how to add and multiply to make 12. You should also know how to subtract from 12 and how to divide 12.

Using arithmetic

A The children had a picnic. On the way to the picnic Jack counted 12 horses. Betty counted 9 horses. Jack counted how many more horses than Betty?

B Betty counted 8 lambs. 3 lambs were eating. The others were sleeping. How many of them were sleeping?

C A farmer had 11 white ducks and 9 brown ducks. He had how many fewer brown ducks than white ducks?

D There were 3 groups of tall trees in the farmer's yard. Each group had 2 trees in it. How many trees were in the yard?

E Nancy saw 7 ducks in one pond and 5 ducks in another pond. Nancy saw how many ducks in all?

F Jack's mother made 12 peanut butter sandwiches. The children ate 9 of them for lunch. How many sandwiches were left after lunch?

G Jack's mother made 6 cupcakes for lunch, and Betty's mother made 6 cupcakes. How many cupcakes did the two mothers make?

H Betty's mother bought 3 peaches from the farmer. Jack's mother bought 7 peaches from him. The two mothers bought how many peaches?

102

1 Have children take turns answering orally these basic facts for the 12 group. Then have them copy the letters A to V on their papers and write the complete equation with the answer after each letter.

2 The children may take turns giving answers to these exercises. Then you may have them write the letters A to V and the answers on their papers.

3 Call on someone to read the statement at the end of these exercises. Discuss the statement briefly with the class.

02-103 Using arithmetic

banded Notes are not considered necessary for these lessons.

bjectives

e child solves various types of problems. He reviews e making of change and the regrouping of tens and es as a preparation for borrowing.

cabulary

ew words **page 102** farmer*, sandwiches, after*; ge 103 picked*, chocolate, pen*

d words **page 102** white*, brown*

mments

r Problems A to O, have children write the equation solving each problem. Remind them to write the uation first with the screen (or a square) in the right ce. Next they should do any computation that is cessary, then rewrite the equation with the answer in- ted in place of the screen. Remind children, too, that o equations are possible in addition situations in ich they must imagine one group joining another.

Answers

Using arithmetic:

A 12−9=[3]
B 8−3=[5]
C 11−9=[2]
D 3×2=[6]
E 7+5=[12] or 5+7=[12]
F 12−9=[3]
G 6+6=[12]
H 3+7=[10] or 7+3=[10]
I 9+[3]=12
J 7+3=[10] or 3+7=[10]
K 17−9=[8]
L 13−7=[6]
M 10−4=[6]
N 7+[3]=10
O 13−8=[5]

Keeping skillful (block 2):

A 4 tens 17 ones
B 1 ten 15 ones
C 8 tens 11 ones
D 3 tens 13 ones
E 5 tens 19 ones
F 6 tens 14 ones
G 2 tens 18 ones
H 7 tens 12 ones
I 6 tens 11 ones
J 1 ten 14 ones
K 3 tens 14 ones
L 8 tens 16 ones
M 5 tens 15 ones
N 6 tens 12 ones
O 4 tens 13 ones
P 7 tens 19 ones
Q 1 ten 12 ones

A 12 − 8 = ▩	L 5 + 7 = ▩	A 17 − 9 = ▩	L 5 + 8 = ▩
B 4 × 3 = ▩	M 12 ÷ 6 = ▩	B 3 + 8 = ▩	M 17 − 8 = ▩
C 6 + 6 = ▩	N 12 − 9 = ▩	C 13 − 5 = ▩	N 6 × 2 = ▩
D 12 − 3 = ▩	O 8 + 4 = ▩	D 12 ÷ 2 = ▩	O 13 − 6 = ▩
E 12 − 7 = ▩	P 2 × 6 = ▩	E 4 + 7 = ▩	P 4 + 9 = ▩
F 9 + 3 = ▩	Q 3 + 9 = ▩	F 9 + 8 = ▩	Q 11 − 5 = ▩
G 12 ÷ 4 = ▩	R 12 − 4 = ▩	G 12 − 9 = ▩	R 8 + 5 = ▩
H 4 + 8 = ▩	S 12 ÷ 3 = ▩	H 11 − 6 = ▩	S 9 + 3 = ▩
I 6 × 2 = ▩	T 7 + 5 = ▩	I 8 + 9 = ▩	T 3 × 4 = ▩
J 12 − 5 = ▩	U 12 − 6 = ▩	J 6 + 7 = ▩	U 13 − 7 = ▩
K 12 ÷ 2 = ▩	V 3 × 4 = ▩	K 13 − 4 = ▩	V 6 + 6 = ▩

Now you should know how to add and multiply to make 12. You should also know how to subtract from 12 and how to divide 12.

Using arithmetic

1

A The children had a picnic. On the way to the picnic Jack counted 12 horses. Betty counted 9 horses. Jack counted how many more horses than Betty?

B Betty counted 8 lambs. 3 lambs were eating. The others were sleeping. How many of them were sleeping?

C A farmer had 11 white ducks and 9 brown ducks. He had how many fewer brown ducks than white ducks?

D There were 3 groups of tall trees in the farmer's yard. Each group had 2 trees in it. How many trees were in the yard?

E Nancy saw 7 ducks in one pond and 5 ducks in another pond. Nancy saw how many ducks in all? 2

F Jack's mother made 12 peanut butter sandwiches. The children ate 9 of them for lunch. How many sandwiches were left after lunch?

G Jack's mother made 6 cupcakes for lunch, and Betty's mother made 6 cupcakes. How many cupcakes did the two mothers make?

H Betty's mother bought 3 peaches from the farmer. Jack's mother bought 7 peaches from him. The two mothers bought how many peaches? 2

I Jack found 9 stones on the farm. He wanted 12 stones. How many more stones did he need to find?

J The farmer had 7 rabbits in a pen and 3 rabbits in the yard. He had how many rabbits in all? 1

K Nancy picked 17 flowers. She gave 9 of them to another girl. Then Nancy had how many flowers?

L Jack counted 13 butterflies and 7 birds. Jack counted how many more butterflies than birds?

M Nancy saw 10 birds in a tree. Four of the birds were brown, and the others were yellow. How many of them were yellow?

N On the way home Betty wanted to buy some chocolate candy. The candy cost 10¢. She had 7¢. How much more money did she need?

O Jack had 13 cents to spend. He bought a toy policeman that cost 8 cents. Then he had how much money? 2

Keeping skillful

3

For each of these problems draw the coins you would use in making change. Under each coin write the number you would say as you make change.

A Carol bought a sandwich for 15¢. She gave the man a quarter.

B Tom bought a book for 26¢. He gave the man a quarter and a nickel.

C Ellen bought a toy wagon for 38¢. She gave the man a half dollar.

D June bought a balloon for 5¢. She gave the man a quarter.

E Don bought a boat for 27¢. He gave the man a half dollar.

4

A fifty-seven = 4 tens ▩ ones
B twenty-five = 1 ten ▩ ones
C ninety-one = ▩ tens ▩ ones
D forty-three = ▩ tens ▩ ones
E sixty-nine = ▩ tens ▩ ones
F seventy-four = ▩ tens ▩ ones
G thirty-eight = ▩ tens ▩ ones
H eighty-two = ▩ tens ▩ ones
I seventy-one = ▩ tens ▩ ones
J twenty-four = ▩ ten ▩ ones
K forty-four = ▩ tens ▩ ones
L ninety-six = ▩ tens ▩ ones
M sixty-five = ▩ tens ▩ ones
N seventy-two = ▩ tens ▩ ones
O fifty-three = ▩ tens ▩ ones
P eighty-nine = ▩ tens ▩ ones
Q twenty-two = ▩ ten ▩ ones

102

1 Direct the children to proceed as follows: read the problem, decide what happens, make an equation with a screen (or square) for the missing number to show what happens, find the missing number, write the equation again with the missing number in it. Direct the children to work Problems A to O in this way.

2 This problem involves imagined additive action in which the two groups do not really combine. Accept either equation shown in the answer key.

103

1 This problem involves imagined additive action in which the two groups do not really combine. Accept either equation shown in the answer key.

2 When the children have finished, let them check their answers against a set provided by you. If any problems have presented special difficulties, help the children who need it. If you wish, the children may work on these problems in small groups, helping one another.

3 Tell the children to follow the directions given for these exercises. Be sure they label each coin with the number of cents it represents.

4 Have the children write two headings, "tens" and "ones," and the letters A to Q on their papers. Under the headings they are to write the numbers that belong in place of the screens. Note that in each exercise the number of tens should be reduced by one. This is preparation for borrowing in subtraction.

104-108 Moving forward

Expanded Notes for this lesson are on pages 261-262.

Objectives

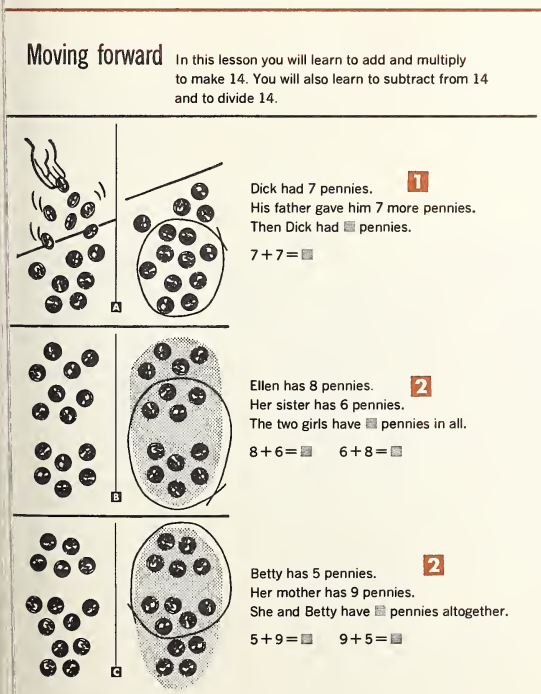
The child learns the basic facts for all four processes for the 14 group (the basic facts whose sums, minuends, products, and dividends are 14).

Vocabulary

New words page 104 Dick*, sister*; page 105 cut*; page 106 breakfast*; page 107 cage

Comments

The basic facts for the 14 group are presented in a manner similar to that in the lessons for the 12 group. When a problem involves real action, the accompanying picture shows the actual combining or separating of groups. As before, when groups are to be combined in imagination only, dotted backgrounds help the pupil imagine the action and result. This background makes it possible to teach an addition basic fact and its reverse together, thus reinforcing the idea that addends may be used in any order. The imagined removal of a group is suggested by dimming off the number of objects to be thought of as removed. Imagined action in division is shown by the circling of equal groups. A ring around a group of ten objects helps the child see a total of 14 as 10 and 4, without counting.

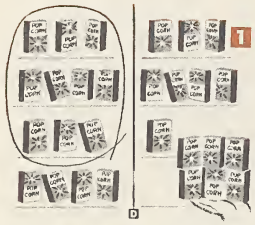

Moving forward
In this lesson you will learn to add and multiply to make 14. You will also learn to subtract from 14 and to divide 14.
A
Dick had 7 pennies.
His father gave him 7 more pennies.
Then Dick had ■ pennies.
7+7=■
1
B
Ellen has 8 pennies.
Her sister has 6 pennies.
The two girls have ■ pennies in all.
8+6=■ 6+8=■
2
C
Betty has 5 pennies.
Her mother has 9 pennies.
She and Betty have ■ pennies altogether.
5+9=■ 9+5=■
2

The addition, subtraction, multiplication, and division basic facts for the 14 group

104

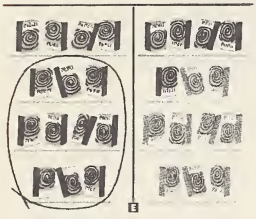
1 Let the children read the problem silently except for the equation. Then relate the text to the first scene of Movie A by asking questions about the size of the original group and the size of the group added. After children have looked at the second scene, ask how many pennies are inside the ring and how many outside. Remind them that this is an easy way to "see" 14 without counting. Let a pupil state in an equation what happened in Movie A. Call on another pupil to read and complete the equation.

2 Treat this movie and its text similarly, but point out that one group does not join another group in this movie. Instead, the dotted background indicates that the children are to imagine that the two groups have joined. Explain that the equation may be written in two ways (5+9=14 and 9+5=14), because it does not matter which group of pennies is thought of as joining the other.



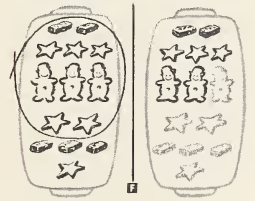
There are 14 boxes of popcorn
in the store.
Bob is buying 6 of them to take home
Then how many boxes of popcorn
will be left in the store?

14 − 6 = ■



There are 14 boxes in the store. 2
9 boxes have candy in them.
The others have cookies in them.
How many boxes have cookies in them?

14 − 9 = ■



There are 14 cookies on the tray.
Carol cut out 7 of them. 3
Her sister cut out the others.
How many cookies did her sister cut out?

14 − 7 = ■

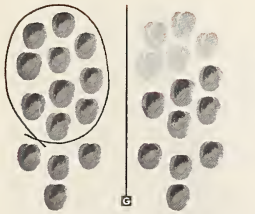
105

105

1 Get the children to determine the size of the total group in the first scene of this movie. Ask questions to call attention to the separating action in the second scene. Relate the text to the movie, stressing the minus sign as showing this separating action and the equation as showing what is happening. Ask a pupil to read the equation, supplying the missing number.

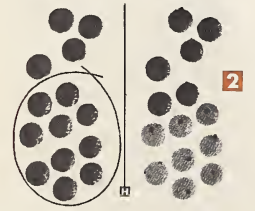
2 Ask a pupil to read the text and, as he reads, to point to the movie to illustrate the story. Remind pupils that the dimmed-off boxes are those that they imagine are being taken away. Ask a pupil to read aloud the equation that shows what is happening, saying the missing number.

3 Adapt Note 2 to this movie and its text.



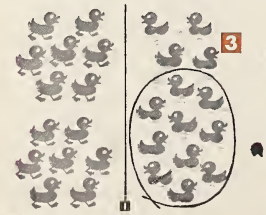
Mother has 14 peaches.
5 of them are for breakfast. 1
The others are for lunch.
How many peaches are there for lunch?

14 − 5 = ■



The children bought 14 oranges.
They ate 8 of them on Monday
and the rest on Tuesday.
How many of the oranges did they eat
on Tuesday?

14 − 8 = ■



■ groups of ducks are going to the pond.
There are ■ ducks in each group.
Now how many ducks are in the pond?

2 sevens = ■ 2 times 7 = ■ 4
7 multiplied by 2 = ■
Multiply 7 by 2. 2 × 7 = ■

106

106

1 Ask the class to read the problem and look at Movie G. Ask how many peaches are in the first scene. Point out that the ring will help them see the number without counting. Have a child read aloud the text opposite the picture. Ask how the second scene shows that we are to imagine that some of the peaches were eaten for breakfast and some were left for lunch. Have a pupil read the equation in the text, saying the missing number.

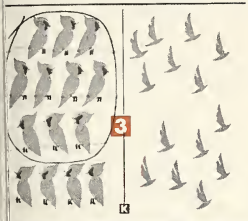
2 Adapt Note 1 to this movie and its text.

3 Direct the pupils to look at the movie. Get the children to discover that the two groups of ducks in the first scene are equal in size. Ask how many are in each group. Get pupils to notice in the second scene that the two equal groups have combined. Ask how many ducks are in the new total group.

4 Have the text and equation read, with the missing numbers supplied from the picture.

There are ▢ groups of chickens.
How many chickens are in each group?
There are ▢ chickens in all. 2

7 twos = ▢ 7 times 2 = ▢
2 multiplied by 7 = ▢
Multiply 2 by 7. 7 × 2 = ▢



How many birds are on the fence?
Now they are flying away in groups of 7.
▢ groups of 7 birds are flying away. 4

14 divided by 7 = ▢
Divide 14 by 7. 14 ÷ 7 = ▢

▢ birds are in the big cage.
The man is going to put them into little cages.
He will put 2 birds into each cage. 6
How many cages will he need?
He will need 1 cage for each group of ▢ birds.

14 divided by 2 = ▢
Divide 14 by 2. 14 ÷ 2 = ▢

1

14 − 9 = ▢	H	2 × 7 = ▢	A	Subtract 7 from 11.	H	3 × 4 = ▢
7 × 2 = ▢	I	8 + 6 = ▢	B	9 plus 3 equals ▢.	I	10 − 8 = ▢
7 + 7 = ▢	J	14 − 5 = ▢	C	Multiply 2 by 6.	J	5 + 6 = ▢
14 − 6 = ▢	K	5 + 9 = ▢	D	Divide 10 by 5.	K	12 ÷ 4 = ▢
14 ÷ 7 = ▢	L	14 ÷ 2 = ▢	E	12 minus 5 equals ▢.	L	3 + 9 = ▢
9 + 5 = ▢	M	6 + 8 = ▢	F	Add 8 to 9.	M	4 × 2 = ▢
14 − 7 = ▢	N	14 − 8 = ▢	G	Subtract 6 from 13.	N	11 − 4 = ▢

3 Now you can add and multiply to make 14. You can also subtract from 14, and divide 14.

Using arithmetic

Jack had 17¢ to spend at the circus, nd Don had 9¢ to spend. Don had ow many fewer cents to spend ıan Jack?

The children saw 8 clowns. of the clowns were riding ponies. he other clowns were marching. ow many of them were marching?

7 elephants were in the ring. hen 5 more elephants marched ıto the ring. How many elephants ere in the ring then?

4 bears were in a cage. A man ut 3 more bears in the cage. Then ow many bears were in the cage?

Some ponies were running the ring. They were running groups of 2. Don counted 5 groups ponies. How many ponies ere running in the ring?

F Father bought a box of candy at the circus. There were 8 large pieces and 5 small pieces of candy in the box. How many pieces of candy were in the box?

G Bill had 12 cents to spend for balloons. The balloons cost 4 cents each. How many balloons could Bill buy?

H A bag of popcorn cost 11¢. Betty had 5¢. How many more cents did she need to buy the popcorn?

I A bag of peanuts that Dick wanted to buy cost 14¢. He had 9¢. How much more money did he need to buy the peanuts?

J 10 circus ponies were running in the ring. They separated into groups of 5. Then there were how many groups of circus ponies?

107

1 Ask the pupils how many groups of two there are in the first scene of Movie J. Remind them that the background in the second scene is to help them imagine the groups as coming together. Have them find how many chickens there are altogether.

2 Ask a pupil to put in the missing numbers as he reads the text aloud.

3 Let the children examine the first scene of Movie K and determine the size of the group. Let them tell what is happening in the second scene. Be sure they note that the birds are flying away in two equal groups. Ask what this separation into equal groups suggests.

4 Have a pupil read the text.

5 Ask how many birds are in the large cage in the first scene. Now ask how many birds are in each circled group in the second scene and how many groups there are.

6 Ask a pupil to read the text.

108

1 Let the children take turns reading this set of exercises, saying the answers. If you wish, you may give them more practice with the 14 group by having them write the equations and answers on their papers.

2 The children may take turns answering aloud this set of exercises. For Exercises A to G you may ask them to state the equations before answering, if you prefer. Then you may have the class write the answers to all the exercises.

3 Ask the pupils to read the statement at the end of the lesson.

108-109 Using arithmetic

Expanded Notes are not considered necessary for these lessons.

Objectives

The child solves various types of problems. He applies his knowledge of the number system.

Vocabulary

New words page 108 circus*, ring, could*; page 109 sold, puzzle, before*

Old words page 108 clowns*, elephants*

Comments

Direct the children to read each problem. They should decide what happened and write an equation that shows what happened, using a screen (or square) for the missing number. Next they should rewrite the equation, this time supplying the missing number.

When the children have finished, let them check their work against answers you have supplied. If some of the problems have proved difficult for several children, divide pupils into small groups so that they can help one another.

The section called "Thinking straight" can be presented as a game consisting of two puzzles. Let a pupil read the directions for the first puzzle aloud. Then write the first four exercises on the board and help the children fill in the missing numbers. Get them to see that only a 1 or a 2 can be used for Exercise A. Complete the first four numbers to make sure the children understand the nature of the number sequence. Then let them copy the puzzle on paper and complete it. Since there are many ways of filling in the puzzle, suggest that they look at each other's papers when they have finished. They will then have an opportunity to actually see that there are different ways of completing it. Encourage pupils to find more than one solution.

Treat the second puzzle in the same way. Note that this puzzle requires a downward sequence, with 10 as the smallest possible number in Exercise P.

Answers

Using arithmetic:

A $17-9=[8]$
B $8-3=[5]$
C $7+5=[12]$
D $4+3=[7]$
E $5\times2=[10]$
F $8+5=[13]$ or $5+8=[13]$
G $12\div4=[3]$
H $5+[6]=11$
I $9+[5]=14$
J $10\div5=[2]$
K $8-6=[2]$
L $5+5=[10]$
M $8-6=[2]$
N $10\div2=[5]$
O $2\times5=[10]$
P $11-5=[6]$
Q $3\times4=[12]$
R $7+[4]=11$
S $12-8=[4]$
T $8+[3]=11$

Thinking straight:

There are many possible ways of answering these two exercises. The following is one possible set of answers for the first puzzle:

A 11	E 51	I 60	M 81
B 21	F 55	J 67	N 85
C 22	G 58	K 68	O 89
D 23	H 59	L 72	P 91

The following is one possible set of answers for the second puzzle:

A 85	E 69	I 52	M 33
B 81	F 65	J 51	N 29
C 75	G 58	K 49	O 25
D 74	H 55	L 36	P 10

A	14−9=▢	H	2×7=▢	A	Subtract 7 from 11.	H	3×4=▢
B	7×2=▢	I	8+6=▢	B	9 plus 3 equals ▢.	I	10−8=▢
C	7+7=▢	J	14−5=▢	C	Multiply 2 by 6.	J	5+6=▢
D	14−6=▢	K	5+9=▢	D	Divide 10 by 5.	K	12÷4=▢
E	14+7=▢	L	14÷2=▢	E	12 minus 5 equals ▢.	L	3+9=▢
F	9+5=▢	M	6+8=▢	F	Add 8 to 9.	M	4×2=▢
G	14−7=▢	N	14−8=▢	G	Subtract 6 from 13.	N	11−4=▢

Now you can add and multiply to make 14. You can also subtract from 14, and divide 14.

Using arithmetic

A Jack had 17¢ to spend at the circus, and Don had 9¢ to spend. Don had how many fewer cents to spend than Jack? 1

B The children saw 8 clowns. 3 of the clowns were riding ponies. The other clowns were marching. How many of them were marching?

C 7 elephants were in the ring. Then 5 more elephants marched into the ring. How many elephants were in the ring then?

D 4 bears were in a cage. A man put 3 more bears in the cage. Then how many bears were in the cage?

E Some ponies were running in the ring. They were running in groups of 2. Don counted 5 groups of ponies. How many ponies were running in the ring?

F Father bought a box of candy at the circus. There were 8 large pieces and 5 small pieces of candy in the box. How many pieces of candy were in the box? 2

G Bill had 12 cents to spend for balloons. The balloons cost 4 cents each. How many balloons could Bill buy?

H A bag of popcorn cost 11¢. Betty had 5¢. How many more cents did she need to buy the popcorn?

I A bag of peanuts that Dick wanted to buy cost 14¢. He had 9¢. How much more money did he need to buy the peanuts?

J 10 circus ponies were running in the ring. They separated into groups of 5. Then there were how many groups of circus ponies?

K There were 8 horses and 6 ponies in the circus ring. How many more horses than ponies were in the ring?

L 5 horses were marching in the ring. 6 more horses marched in. How many horses were in the ring then?

M 6 elephants and 8 bears were in another ring. There were how many fewer elephants than bears in the ring?

N A man sold 10 large boxes of popcorn to some children. Each child bought 2 boxes. How many children bought the popcorn?

O 2 groups of clowns were riding in cars. There were 5 clowns in each group. How many clowns were riding in cars?

P Eleven clowns were in the ring. Five clowns carried balloons. The rest did not. How many clowns did not carry balloons?

Q 3 groups of 4 elephants each marched into the ring. How many elephants marched into the ring?

R 11 clowns came in. 7 of them had firemen's hats. How many more firemen's hats were needed for all the clowns to have firemen's hats?

S 12 dogs were running in the ring. 8 of them were brown. The others were white. How many were white?

T 8 ponies were marching in the ring. More ponies marched into the ring. Don counted 11 ponies. How many more ponies had marched in? 1

Thinking straight

This is a number puzzle. One figure is missing in each number. Can you think of some figure to use so that each number will be larger than the number before it? 2

	1	E	5▢	I	▢0	M	▢1
	2▢	F	▢5	J	▢7	N	8▢
	2▢	G	▢8	K	6▢	O	▢9
	▢3	H	5▢	L	▢2	P	9▢

In this number puzzle, one figure is missing in each number also. Can you think of some figure to use so that each number will be smaller than the number before it? 3

A	8▢	E	▢9	I	▢2	M	▢3
B	▢1	F	6▢	J	5▢	N	2▢
C	▢5	G	▢8	K	4▢	O	2▢
D	7▢	H	5▢	L	▢6	P	1▢

108

1 Tell the children to read each problem (A to T) and think about what is happening. For each problem have them write an equation that shows what is happening, using a screen (or square) for the missing number. Then they should rewrite the equation, supplying the missing number.

2 Note that in this problem it does not matter which group is thought of as joining the other group. Consequently, either equation (8+5 =▢ or 5+8=▢) is acceptable.

109

1 When children have finished, let them check their work against answers supplied by you. If certain problems have been missed by many of the children, take time to work with objects so that they can see where they went astray in their thinking.

2 Read the introduction to the first puzzle in "Thinking straight." Write the first four exercises on the board and explain that the missing number in A could be 1, making the number 11, or 2, making the number 21. Explain that each number should be larger than the one before it, and that various figures can be put in place of the screens. Then let each child write the entire puzzle on paper.

3 Read the directions for the second puzzle. Ask a pupil to supply a figure for A. Give the pupils help with the first four exercises. Be sure they understand that each number should be smaller than the one before it. Let each child write his answers on paper.

110-113 Moving forward

Expanded Notes for this lesson are on pages 262-264.

Objectives

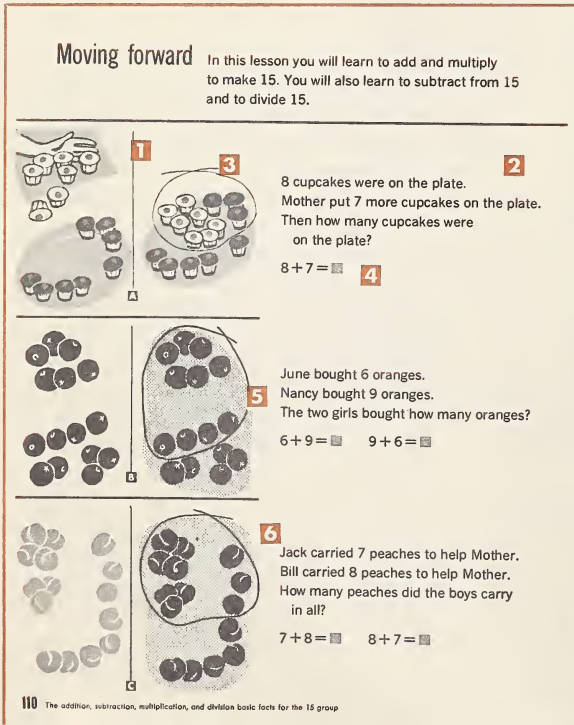
The child learns the basic facts for all four processes for the 15 group (the basic facts whose sums, minuends, products, and dividends are 15).

Vocabulary

New words page 111 Mary; page 112 hive*
Old words page 112 bees*

Comments

The basic facts for the 15 group are presented in a way similar to that used for the 14 group. Here again the actual combining and separating of groups are shown when the story involves real action. In addition and multiplication problems where no real action takes place, dotted backgrounds help the pupil imagine the supposed combining action and result. In imagined action in addition, either group can be thought of as joining the other group. Thus it is possible to teach a basic fact and its reverse at the same time. Subtraction is suggested by dimming off the number of objects to be thought of as removed. Imagined division is shown by the circling of equal groups. Again, the device of ringing a group of ten objects is used to help the child see 15 without counting.

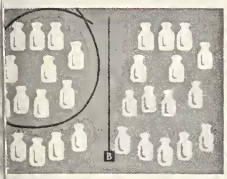

Moving forward
In this lesson you will learn to add and multiply to make 15. You will also learn to subtract from 15 and to divide 15.
1
2
3
8 cupcakes were on the plate.
Mother put 7 more cupcakes on the plate.
Then how many cupcakes were on the plate?
8+7=■
4
A
5
June bought 6 oranges.
Nancy bought 9 oranges.
The two girls bought how many oranges?
6+9=■
9+6=■
B
6
Jack carried 7 peaches to help Mother.
Bill carried 8 peaches to help Mother.
How many peaches did the boys carry in all?
7+8=■
8+7=■
C
110 The addition, subtraction, multiplication, and division basic facts for the 15 group

110

1 Tell the children to look at Movie A and describe what is happening.
2 Let a child read the text and relate it to the pictures.
3 Note that the ring in the second scene makes it easy to identify 15.
4 Call on a pupil to read the equation and tell the missing number.
5 Ask a pupil to read the text for Movie B. Direct attention to the movie and get a pupil to tell how many oranges are in each group in the first scene. Let another pupil explain what the background indicates in the second scene. Ask him which group he imagined as joining the other. Ask what the ring helps us see. Have pupils interpret the two equations in terms of the second scene.
6 Treat Movie C in the same way as Movie B.

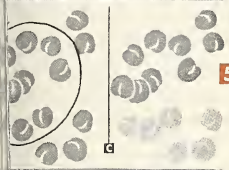
15 apples are on the lunchroom table. 2
Don is taking 7 of them away.
How many apples will be left on the table?

15 − 7 = ■



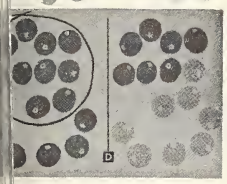
There are 15 bottles of milk on the lunchroom table. 3
9 of them are sold.
The others are not sold.
How many bottles of milk are not sold?

15 − 9 = ■ 4



15 peaches are in the lunchroom.
6 of them are sold. 5
The others are not sold.
How many peaches are not sold?

15 − 6 = ■



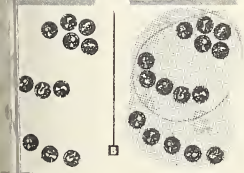
5

Mary has 15 oranges in the lunchroom.
She got 8 of them from a shelf.
She got the others from a box.
How many did she get from the box?

15 − 8 = ■

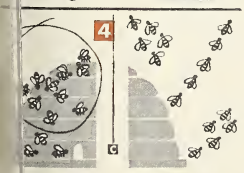
■ groups of bees are flying to the hive.
How many bees are in each group?
Now how many bees are on the hive?

5 threes = ■ 5 times 3 = ■ 2
3 multiplied by 5 = ■
Multiply 3 by 5. 5 × 3 = ■



How many groups of pennies are there?
There are ■ pennies in each group.
There are ■ pennies in all. 3

3 fives = ■ 3 times 5 = ■
5 multiplied by 3 = ■
Multiply 5 by 3. 3 × 5 = ■



How many bees are on the hive?
Now they are flying away in groups of 5.
They are flying away in ■ groups of five.

15 divided by 5 = ■
Divide 15 by 5. 15 ÷ 5 = ■

Don's ■ pennies are on the table. 5
He is going to buy pieces of candy.
Each piece of candy costs 3 pennies.
How many pieces of candy can Don buy?

15 divided by 3 = ■
Divide 15 by 3. 15 ÷ 3 = ■

111

1 Suggest that the pupils look at Movie A, decide how many apples are in the first scene, and describe what is happening in the second scene. Call on someone to put this story in equation form.

2 Now have a pupil read the text and the equation aloud, saying the missing number.

3 Ask pupils to read this problem, except for the equation. Call attention to Movie B. Ask pupils how many bottles of milk are in the first scene. For the second scene ask questions to make the pupils realize that the dimmed-off bottles are to be imagined as gone. Ask how many bottles are dimmed off. Call on someone to read the sentence that tells why the bottles are dimmed off. Then ask how many bottles are not sold.

4 Have a pupil read the equation for Movie B, saying the missing number.

5 Proceed in the same way with this movie.

112

1 Direct attention to the first scene. Be sure the children discover that the bees are flying in equal groups toward the hive. In the second scene they should arrive at the conclusion that these equal groups have combined into one large group. Ask why the ring is used.

2 Let a pupil read the text, answering the questions and saying the missing numbers.

3 Have pupils read the problem. Tell them to use Movie B to answer the question and find the missing numbers.

4 Get pupils to determine the number of bees in the first scene, the equality of the groups flying away in the second scene, and the number of groups. Let a pupil read the text, supplying all the missing numbers.

5 Let a pupil read the problem for Movie D. Ask how many pennies are in the first scene. Get pupils to decide, in the second scene, that the pennies are grouped in threes because each piece of candy costs 3 pennies.

1

A $5\times3=$	G $15\div5=$		
B $7+8=$	H $15-9=$		
C $15-6=$	I $8+7=$		
D $15\div3=$	J $3\times5=$		
E $9+6=$	K $15-7=$		
F $15-8=$	L $6+9=$		

2

A Divide 14 by 2.	G $4+9=$
B Subtract 7 from 12.	H $12\div3=$
C 8 plus 6 equals .	I $15-6=$
D Multiply 4 by 3.	J $3\times4=$
E Divide 12 by 6.	K $17-8=$
F Add 9 to 6.	L $5+8=$

3 Now you should be able to add and multiply to make 15. You should also know how to subtract from 15 and how to divide 15.

Using arithmetic

A Mother made 12 sandwiches and put them into bags for a picnic lunch at a farm. She put 2 sandwiches into each bag. How many bags did she use?

B She put 9 cups into the picnic basket. Six of them were red, and the others were yellow. How many of the cups were yellow?

C She had 8 apples and 6 peaches for the picnic. She had how many fewer peaches than apples?

D Mother put 15 cookies into bags. She put 3 cookies into each bag. How many bags did she use?

E On the way, the children counted animals. Mary counted 8 horses, and Don counted 7 pigs. How many animals did they count in all?

F Jack counted 11 sheep. His sister counted 6 sheep. Jack counted how many more sheep than his sister?

G The farmer showed the children the farm animals. He had 15 cows. Six of them were in a field. The others were in the barn. How many cows were in the barn?

H The children also saw his ducks. Six of them were in the pond, and eight were on the bank. How many ducks did the children see in all?

I The farmer planted 3 groups of trees, with 2 trees in each group. How many trees did he plant?

J Nancy saw 3 groups of birds in a tree. There were 5 birds in each group. How many birds in all did Nancy see in the tree?

113

113

1 Note that all twelve basic facts for 15 are included in Exercises A to L. Let the children take turns completing these equations. You may give them further practice with the 15 group by having them write the equations with answers on their papers.

2 Let the pupils take turns giving answers to Exercises A to L on mixed basic facts. For Exercises A to F you may prefer to let the pupils state each equation before giving its answer. If you wish, have the class write a completed equation for each exercise.

3 Discuss closing statement briefly with the class.

113-114 Using arithmetic

Expanded Notes are not considered necessary for these lessons.

Objectives

The child practices solving various types of problems. He reviews the number system and basic facts taught thus far.

Vocabulary

New words page 113 animals*, sheep*, field*; page 114 black*, said*, I*

Comments

Have the children read the problems in "Using arithmetic." Let them describe what is happening in each problem and write an equation that tells what is happening. They should use a screen (or square) for the missing number in each problem and then rewrite the equation supplying the answer. Remind the children that in some addition problems the equation may be written in either of two ways, for it does not matter which group they imagine as joining the other.

The section called "Keeping skillful" will help the pupil review the basic facts presented so far and will give him practice in regrouping in the number system.

Answers

Using arithmetic:

A $12\div2=[6]$	G $15-6=[9]$	L $6-2=[4]$
B $9-6=[3]$	H $6+8=[14]$ or $8+6=[14]$	M $15-7=[8$
C $8-6=[2]$		N $7\times2=[14$
D $15\div3=[5]$	I $3\times2=[6]$	O $4\times3=[12$
E $8+7=[15]$ or $7+8=[15]$	J $3\times5=[15]$	P $8+[7]=1$
	K $5+3=[8]$ or $3+5=[8]$	Q $3+[5]=8$
F $11-6=[5]$		R $11-9=[2$

Keeping skillful:

A 5 tens	D 3 ones	G 3 ten
B 18 ones	E 3 tens	H 2 one
C 5 tens	F 17 ones	I 9 ten

A 5×3=	G 15÷5=	A Divide 14 by 2.	G 4+9=
B 7+8=	H 15−9=	B Subtract 7 from 12.	H 12÷3=
C 15−6=	I 8+7=	C 8 plus 6 equals .	I 15−6=
D 15÷3=	J 3×5=	D Multiply 4 by 3.	J 3×4=
E 9+6=	K 15−7=	E Divide 12 by 6.	K 17−8=
F 15−8=	L 6+9=	F Add 9 to 6.	L 5+8=

Now you should be able to add and multiply to make 15. You should also know how to subtract from 15 and how to divide 15.

Using arithmetic

A Mother made 12 sandwiches and put them into bags for a picnic lunch at a farm. She put 2 sandwiches into each bag. How many bags did she use? 1

B She put 9 cups into the picnic basket. Six of them were red, and the others were yellow. How many of the cups were yellow?

C She had 8 apples and 6 peaches for the picnic. She had how many fewer peaches than apples?

D Mother put 15 cookies into bags. She put 3 cookies into each bag. How many bags did she use?

E On the way, the children counted animals. Mary counted 8 horses, and Don counted 7 pigs. How many animals did they count in all? 2

F Jack counted 11 sheep. His sister counted 6 sheep. Jack counted how many more sheep than his sister?

G The farmer showed the children the farm animals. He had 15 cows. Six of them were in a field. The others were in the barn. How many cows were in the barn?

H The children also saw his ducks. Six of them were in the pond, and eight were on the bank. How many ducks did the children see in all? 2

I The farmer planted 3 groups of trees, with 2 trees in each group. How many trees did he plant?

J Nancy saw 3 groups of birds in a tree. There were 5 birds in each group. How many birds in all did Nancy see in the tree?

K Five kittens were in one box in the barn, and three kittens were in another box. How many kittens all were in the boxes? 1

L Six of the kittens were black, and two were white. There were how many fewer white kittens than black ones?

M Mary counted 15 blackbirds on a fence. Seven blackbirds flew away. How many blackbirds were left on the fence?

N The children counted 7 groups of chickens. There were 2 chickens in each group. How many chickens did the children count in all?

O Mother put 4 groups of cookies on the lunch table. There were 3 cookies in each group. How many cookies did she put on the table?

P The farmer put 8 apples into a box that would hold 15 apples. How many more apples could the farmer have put into the box?

Q The farmer said, "I had 3 beehives. Then I bought some more. Now I have 8 beehives." How many more beehives did he buy?

R He also said, "I have nine sheep and eleven lambs." He had how many more lambs than sheep? 2

Keeping skillful

3 tens 27 ones = 3
tens 7 ones
58 = 4 tens ones
61 = tens 11 ones
5 tens 43 ones =
9 tens ones
1 ten 21 ones =
tens 1 one
97 = 8 tens ones
49 = tens 19 ones
7 tens 22 ones =
9 tens ones
6 tens 35 ones =
tens 5 ones

4	4	4
A 15÷5=	A 11−9=	A 3×5=
B 6+7=	B 14÷7=	B 11−2=
C 17−9=	C 17−8=	C 14−9=
D 6×2=	D 6+8=	D 7+6=
E 9+8=	E 8+3=	E 12÷3=
F 15−9=	F 2×6=	F 4+7=
G 8+4=	G 14−5=	G 12−5=
H 12÷4=	H 9+4=	H 7×2=
I 13−8=	I 12÷2=	I 15−6=
J 4×3=	J 5+6=	J 8+5=
K 15÷3=	K 3×4=	K 11−6=
L 13−5=	L 14÷2=	L 6+6=
M 12÷6=	M 9+5=	M 2×7=
N 5×3=	N 12−8=	N 14−8=

113

1 Have the children read each problem and write the equation that describes what is happening, using the screen (or square) for the missing number. They then are to decide on the answer and rewrite the equation, supplying the missing number.

2 Remind pupils that for this problem either of two equations is acceptable (see answers), since either group can be imagined as joining the other.

114

1 Remind pupils that for this problem either of two equations is acceptable (see answers), since either group can be imagined as joining the other.

2 When the children have finished, let them check their answers. Give individual help to pupils who seem to need it. Be especially careful to see that these children write the proper equation for each problem.

3 For these exercises the children may write the answers to A to I. Then they may take turns reading the exercises and saying their answers aloud.

4 The pupils may first read aloud and complete the equations in the three sections lettered A to N. Then they may write three columns of letters from A to N and write the answers for the equations opposite the letters.

115-118 Moving forward

Expanded Notes for this lesson are on pages 264-265.

Objectives

The child learns the basic facts for all four processes for the 16 group (the basic facts whose sums, minuends, products, and dividends are 16).

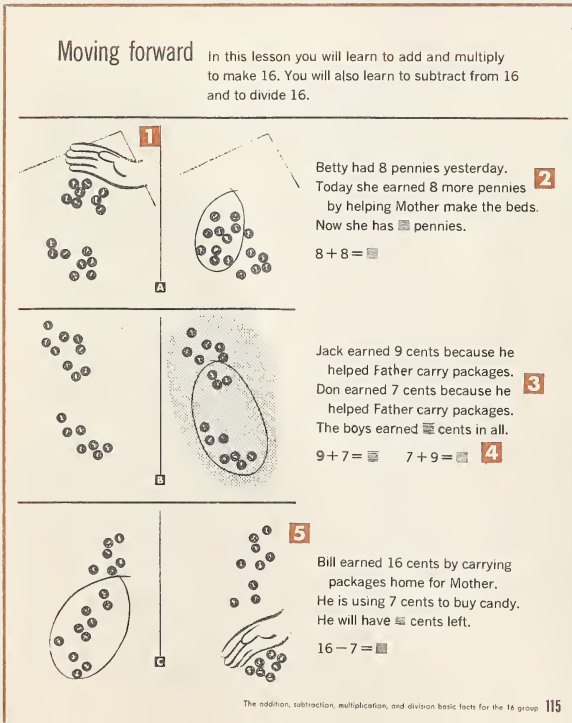
Vocabulary

New words page 115 earned*, packages; page 117 kinds*, marbles

Old words page 115 beds*

Comments

The basic facts for the 16 group are presented for study in a manner similar to that for the 15 group. Problems involving both real and imagined action are used. Each of the four processes is pictorialized to show both real and imagined action. Dotted backgrounds for addition and multiplication indicate to the child that he is to imagine the groups as being put together. Dimming off in subtraction points out the group that is imagined as being removed, and in division rings around the equal groups indicate the imagined grouping of the objects. As before, a circle around 10 objects makes it easy to identify 16 without counting. Some children may be helped by using objects to duplicate the work of the pictures. Be sure to use small objects (jacks, beans, corks) that can be put into compact groups and be observed at a glance.


Moving forward
In this lesson you will learn to add and multiply to make 16. You will also learn to subtract from 16 and to divide 16.
1
A
Betty had 8 pennies yesterday.
Today she earned 8 more pennies by helping Mother make the beds.
Now she has ▢ pennies.
8+8=▢
2
B
Jack earned 9 cents because he helped Father carry packages.
Don earned 7 cents because he helped Father carry packages.
The boys earned ▢ cents in all.
9+7=▢
7+9=▢
3
4
C
Bill earned 16 cents by carrying packages home for Mother.
He is using 7 cents to buy candy.
He will have ▢ cents left.
16−7=▢
5
The addition, subtraction, multiplication, and division basic facts for the 16 group
115

115

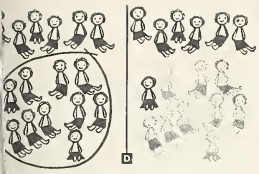
1 Tell the children to look at the first scene of Movie A and to describe what is happening. Let them look at the second scene. They should realize almost immediately that the two groups have been combined, that the ring encloses 10 pennies, and that the total is 16.

2 Call on a pupil to read the text and equation.

3 Let the class read the problem and examine Movie B. Get pupils to identify Jack's money and Don's money in the first scene. Ask what the dotted background indicates in the second scene.

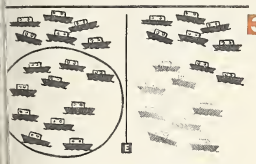
4 Ask a pupil to read the equations aloud, saying the missing numbers. Point out that the equation can be written in two ways and call on a pupil to explain why.

5 Ask a pupil to explain what is happening in Movie C. Be sure he points out the size of the group in the first scene and the separation action in the second scene. Let a pupil read the text and relate it to the picture.



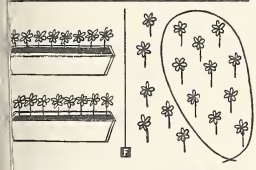
1 Betty and Carol bought 16 dolls.
Betty bought 9 of the dolls.
Carol bought the others.
How many dolls did Carol buy? 2

16 − 9 = ■



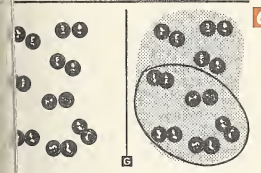
3 Yesterday Bill and Don bought 16 small boats.
Bill bought 8 of them.
Don bought the others.
How many boats did Don buy?

16 − 8 = ■



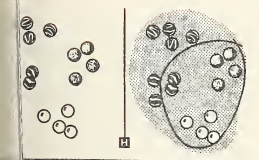
Mary bought 2 boxes of flowers.
There were 8 flowers in each box.
She bought ■ groups of flowers. 4
■ flowers were in each group.
She planted the flowers together.
She planted ■ flowers. 5

Multiply 8 by 2. 2 × 8 = ■



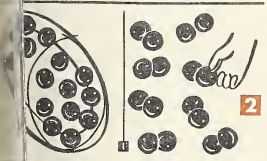
6 The pennies Nancy earned today are on a table.
She earned ■ groups of pennies.
There are ■ pennies in each group.
She earned ■ pennies in all.

Multiply 2 by 8. 8 × 2 = ■



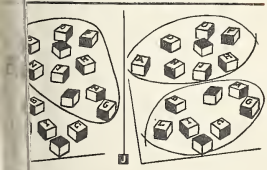
Dick has 4 kinds of marbles.
He has 4 marbles of each kind. 1
He has ■ groups of marbles.
■ marbles are in each group.
He has ■ marbles in all.

Multiply 4 by 4. 4 × 4 = ■



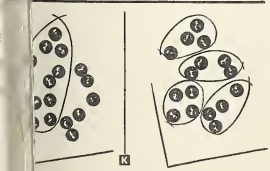
The ■ cookies June made are on the plate.
Now she is putting them into groups.
■ cookies are in each group. 2
There are ■ groups of 2.

Divide 16 by 2. 16 ÷ 2 = ■



There are ■ blocks on the table. 3
Tom is going to put them in groups of 8.
Then there will be ■ groups of blocks.

Divide 16 by 8. 16 ÷ 8 = ■



Ellen is going to buy candy with the pennies on the table. 4
Each piece of candy costs 4 pennies.
Ellen can buy ■ pieces of candy.

Divide 16 by 4. 16 ÷ 4 = ■

116

1 Tell the pupils to read the problem and get them to identify, in the second scene of the movie, the dolls Betty bought and the dolls Carol bought. They should associate the 9 dolls Betty bought with the dimmed-off group of 9.

2 Ask a pupil to read the problem and equation aloud, answering the question and supplying the missing number.

3 Proceed with Movie E in the same way.

4 Ask a pupil to read the problem and to explain Movie F. Be sure pupils understand the purpose of the ring in the second scene. Let a pupil tell why multiplication is suggested (two *equal* groups are combined).

5 Let another pupil read the text and equation, saying the missing numbers.

6 Proceed similarly with Movie G. Ask a pupil to explain the purpose of the dotted background in the second scene.

117

1 When pupils read this problem, they should associate the information given with the two scenes of Movie H. They should understand the purpose of the background and the ring in the second scene. Call on a pupil to read the text aloud, saying the missing numbers.

2 Examination of Movie I should immediately suggest division to the children. Have them read the text silently. Then ask a pupil to read it aloud, saying the missing numbers.

3 Pupils should read the problem and look at Movie J. They should note that this movie shows imagined action and that the rings in the second scene indicate the groups that are going to be made. Have a pupil read the text, supplying the missing numbers.

4 Treat Movie K and its text in the same way.

1

A $4 \times 4 =$ ☐
B $9 + 7 =$ ☐
C $16 - 8 =$ ☐
D $16 \div 8 =$ ☐
E $8 \times 2 =$ ☐
F $16 - 7 =$ ☐
G $7 + 9 =$ ☐
H $16 \div 2 =$ ☐
I $16 - 9 =$ ☐
J $8 + 8 =$ ☐
K $2 \times 8 =$ ☐
L $16 \div 4 =$ ☐

2

A 11 minus 6 = ☐
B Divide 12 by 2.
C Add 2 to 7.
D Subtract 6 from 13.
E Multiply 5 by 2.
F 8 divided by 2 = ☐

3

G $7 + 8 =$ ☐
H $10 \div 2 =$ ☐
I $12 - 9 =$ ☐
J $2 \times 4 =$ ☐
K $6 + 9 =$ ☐
L $7 \times 2 =$ ☐

4 Now you should understand how to add and multiply to make 16. You should also understand how to subtract from 16 and how to divide 16.

Using arithmetic

A Nancy made 16 chocolate cookies for a party. She put 9 of them into a box and the others on a plate. How many did she put on the plate?

B She picked 7 red flowers and 9 white ones for the table. She picked how many fewer red flowers than white ones?

C She put the 16 flowers in vases. She put 8 flowers in each vase. How many vases did she use?

D Nancy put 2 groups of candles on the tables. There were 3 candles in each group. How many candles did she put on the tables?

E Nancy bought 7 bottles of chocolate milk for the party. Her mother said, "You will need 10 bottles in all." How many more bottles should Nancy buy?

F 12 pieces of chocolate candy and 8 pieces of white candy were on a plate. There were how many more pieces of chocolate candy than white candy on the plate?

G Nancy put 6 cups on the table. She said, "I should get more cups, because there will be 10 girls at the party." How many more cups should she get?

H 5 girls came to the party in one car. 4 came in another car. How many girls came in the two cars?

I Nancy showed the girls 4 groups of dolls. There were 3 dolls in each group. How many dolls were there in all?

J The 10 girls separated into groups of 5 to play a game. How many groups of girls were there?

118

118

1 The children may take turns reading the equations and giving the answers. Then, as further practice, have them write the completed equations on their papers.

2 Let the children turn the statements in Exercises A to F into complete equations. Have them take turns reading their equations aloud.

3 They may also take turns reading and completing Equations G to L. Use these exercises as written practice, if you wish.

4 Ask a pupil to read the statement at the end of the lesson aloud. Discuss it briefly.

118-119 Using arithmetic

Exponded Notes are not considered necessory for these lessons.

Objectives

The child practices solving various types of verbal problems. He also reviews regrouping of numbers as a preparation for borrowing in subtraction. He also reviews the basic facts taught thus far.

Vocabuiary

New words page 118 party*, game*; page 119 paper*, bunches, keep*, new*

Comments

For each problem have pupils do these things: read the problem; "see" the situation; write an equation with a screen (or square) for the missing number to show what is happening; and, finally, write the completed equation. Remind the class that in some addition problems the equation may be written in two ways. These alternative ways are shown in the answer key below.

The "Keeping skillful" exercises should be handle separately.

Answers

Using arithmetic:

A $16 - 9 = [7]$
B $9 - 7 = [2]$
C $16 \div 8 = [2]$
D $2 \times 3 = [6]$
E $7 + [3] = 10$
F $12 - 8 = [4]$
G $6 + [4] = 10$
H $5 + 4 = [9]$ or $4 + 5 = [9]$
I $4 \times 3 = [12]$
J $10 \div 5 = [2]$
K $2 \times 4 = [8]$
L $10 - 4 = [6]$
M $2 + 4 = [6]$ or $4 + 2 = [6]$
N $16 - 9 = [7]$
O $9 \div 3 = [3]$
P $10 - 6 = [4]$
Q $16 - 9 = [7]$
R $10 \div 2 = [5]$

Keeping skillful:

A 12 ones
B 3 tens
C 8 tens
D 18 ones
E 14 ones
F 5 tens
G 13 ones
H 7 tens
I 17 ones
J 13 tens
K 3 tens
L 8 tens
M 2 ten
N 8 on
O 4 ten
P 6 on
Q 7 ten
R 8 on

A 4×4=□
B 9+7=□
C 16−8=□
D 16÷8=□
E 8×2=□
F 16−7=□
G 7+9=□
H 16÷2=□
I 16−9=□
J 8+8=□
K 2×8=□
L 16÷4=□

A 11 minus 6=□
B Divide 12 by 2.
C Add 2 to 7.
D Subtract 6 from 13.
E Multiply 5 by 2.
F 8 divided by 2=□
G 7+8=□
H 10÷2=□
I 12−9=□
J 2×4=□
K 6+9=□
L 7×2=□

Now you should understand how to add and multiply to make 16. You should also understand how to subtract from 16 and how to divide 16.

Using arithmetic

A Nancy made 16 chocolate cookies for a party. She put 9 of them into a box and the others on a plate. How many did she put on the plate? 1

B She picked 7 red flowers and 9 white ones for the table. She picked how many fewer red flowers than white ones?

C She put the 16 flowers in vases. She put 8 flowers in each vase. How many vases did she use?

D Nancy put 2 groups of candles on the tables. There were 3 candles in each group. How many candles did she put on the tables?

E Nancy bought 7 bottles of chocolate milk for the party. Her mother said, "You will need 10 bottles in all." How many more bottles should Nancy buy?

F 12 pieces of chocolate candy and 8 pieces of white candy were on a plate. There were how many more pieces of chocolate candy than white candy on the plate?

G Nancy put 6 cups on the table. She said, "I should get more cups, because there will be 10 girls at the party." How many more cups should she get?

H 5 girls came to the party in one car. 4 came in another car. How many girls came in the two cars? 2

I Nancy showed the girls 4 groups of dolls. There were 3 dolls in each group. How many dolls were there in all?

J The 10 girls separated into groups of 5 to play a game. How many groups of girls were there?

K Betty and Nancy played with two groups of paper dolls. There were 4 paper dolls in each group. How many paper dolls did Betty and Nancy play with?

L Four of the 10 girls played jacks. The others did not. How many girls did not play jacks?

M The girls played with Nancy's new kittens. She had 2 kittens in the house and 4 more kittens in the yard. She had how many kittens in all? 1

N Nancy had 16 balloons in a box. She took 9 of them out of the box. How many balloons did she keep in the box?

O Nancy put the 9 balloons in bunches of three. How many bunches of balloons did she make?

P Six of the 10 girls ate at the big table. The others ate at a little table. How many girls ate at the little table?

Q There were 16 pieces of birthday cake. The girls ate 9 pieces in all. How many pieces of birthday cake were left after the party?

R Mary gave Nancy 10 cents on her birthday. Nancy bought toy spoons with the money. Each spoon cost 2 cents. How many spoons did Nancy buy? 2

Keeping skillful

3

72=6 tens □ ones
45=□ tens 15 ones
91=□ tens 11 ones
28=1 ten □ ones
54=4 tens □ ones
69=□ tens 19 ones
33=2 tens □ ones
86=□ tens 16 ones
77=6 tens □ ones
53=4 tens □ ones
49=□ tens 19 ones
94=□ tens 14 ones

M 1 ten 15 ones = □ tens 5 ones
N 4 tens 38 ones = 7 tens □ ones
O 2 tens 23 ones = □ tens 3 ones
P 8 tens 16 ones = 9 tens □ ones
Q 3 tens 47 ones = □ tens 7 ones
R 6 tens 38 ones = 9 tens □ ones

4

A 3×5=□
B 7+□=12
C 5+9=□
D 8×2=□
E 14÷2=□
F 12−8=□
G 4+□=13
H 6÷3=□
I 2×5=□
J 4+□=9
K 2×6=□
L 15−8=□

118

1 Tell the children to read each problem and write the equation (using a screen or square) that describes what is happening. The equation should then be rewritten with the missing number supplied. Have the children work independently without preliminary discussion of the problems.

2 Remind pupils that in addition problems like this two equations are possible, and either of them will be correct.

119

1 Remind pupils that in addition problems like this two equations are possible, and either of them will be correct.

2 When the children have finished writing the equations for the problems let them check their work. Give individual help where it is needed. The children may work in groups and help one another with problems that are especially difficult.

3 In these exercises the children may write answers beside identifying labels (A to R). Then they may read their statements and answers aloud.

4 The children may take turns reading and answering Equations A to L aloud. These exercises may also be used for written work.

120-123 Moving forward

Expanded Notes for this lesson are on pages 265-266.

Objectives

The child learns the basic facts for all four processes for the 18 group (the basic facts whose sums, minuends, products, and dividends are 18).

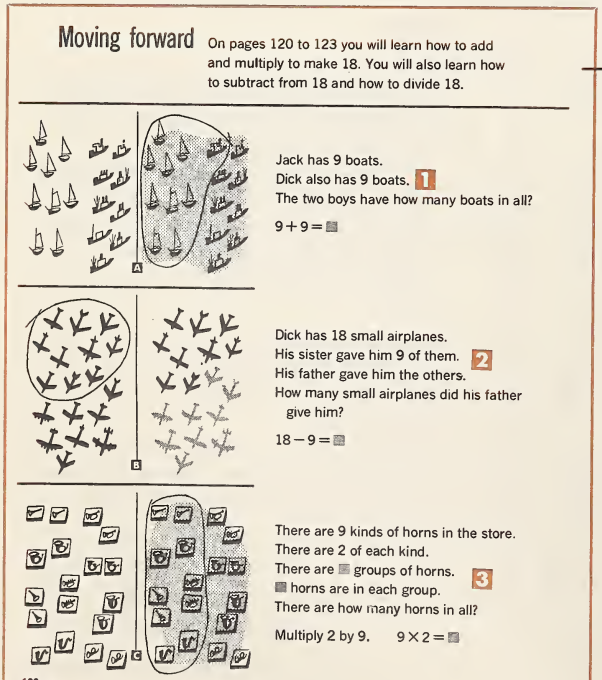
Vocabulary

New words page 122 clerk

Comments

The basic facts for the 18 group are taught with text and illustrations in a manner similar to that used in previous work on the 12, 14, 15, and 16 groups. Only imagined action is used in this lesson, with backgrounds and rings used to suggest groupings. In working with the children on this lesson be sure they understand the use of the ring and dotted background.

You should be aware that the children are now completing those basic facts that involve only 1 ten, and that from now on products and dividends will contain 2 or more tens. (There are no addition or subtraction basic facts with sums or minuends above 18.) In this and succeeding lessons, strive for thorough understanding of 18 as 1 ten 8 ones, of 27 as 2 tens 7 ones, and so on. Children's future success with computation depends, to a high degree, on their understanding of the number system.



Moving forward

On pages 120 to 123 you will learn how to add and multiply to make 18. You will also learn how to subtract from 18 and how to divide 18.

A

Jack has 9 boats.
Dick also has 9 boats. 1
The two boys have how many boats in all?

9 + 9 = ▩

B

Dick has 18 small airplanes.
His sister gave him 9 of them. 2
His father gave him the others.
How many small airplanes did his father give him?

18 − 9 = ▩

C

There are 9 kinds of horns in the store.
There are 2 of each kind.
There are ▩ groups of horns. 3
▩ horns are in each group.
There are how many horns in all?

Multiply 2 by 9. 9 × 2 = ▩

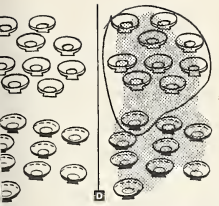
120 The addition, subtraction, multiplication, and division basic facts for the 18 group

120

1 Tell the class to read this problem. Then hav them look at Movie A. Ask a pupil to describ the movie in terms of what happens (imagine in the problem. Be sure the purpose of th background and of the ring are made clea Then have a pupil reread the text and equ tion, saying the answer.

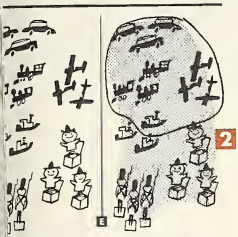
2 After pupils have read this problem, get child to identify the groups in the secon scene. [The 9 dimmed-off airplanes are th ones Dick's sister gave him.] Then have a pu read the entire problem aloud, saying t answer.

3 Direct pupils to read this problem silent Then let a pupil tell how many kinds of hor are in the first scene. Ask how many there a of each kind. Ask how many there are alt gether in the second scene. Have a pupil re the text and the equation, supplying the mi ing numbers.



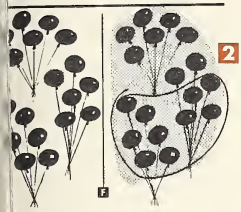
There are 2 kinds of doll plates in the store.
There are 9 plates of each kind.
There are ▢ groups of plates.
▢ plates are in each group.
There are ▢ doll plates in all.

Multiply 9 by 2. $2 \times 9 = \square$



Bill has 6 kinds of toys.
He has 3 toys of each kind.
He has ▢ groups of toys.
There are ▢ toys in each group.
Bill has ▢ toys in all.

Multiply 3 by 6. $6 \times 3 = \square$

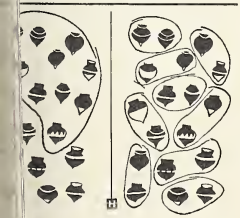


There are 3 bunches of balloons in the store.
There are 6 balloons in each bunch.
▢ groups of balloons are in the store.
▢ balloons are in each group.
There are ▢ balloons in all.

Multiply 6 by 3. $3 \times 6 = \square$

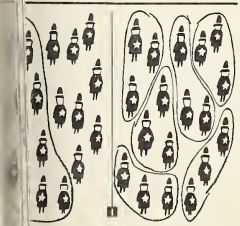
There are ▢ toy animals in the store.
The clerk is going to put them into boxes.
She will put 9 animals into each box.
She will need a box for each group of ▢ animals.
She will need ▢ boxes.

Divide 18 by 9. $18 \div 9 = \square$



There are ▢ tops in the store.
The clerk is going to put them into boxes.
She will put 2 tops into each box.
She will need a box for each group of ▢ tops.
She will need ▢ boxes.

Divide 18 by 2. $18 \div 2 = \square$



▢ toy policemen are in the store.
The clerk is going to put them into boxes.
She will put 3 toy policemen into each box.
She will need a box for each group of ▢ toy policemen.
She will need ▢ boxes.

Divide 18 by 3. $18 \div 3 = \square$

121

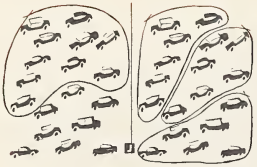
1 Have pupils read this problem. Then direct attention to Movie D. Get the children to identify the two kinds of doll plates and determine the equality of the groups. Ask what the background suggests in the second scene. Let a pupil tell how many plates there are altogether. Ask another pupil to read the text and equation, saying the missing numbers.

2 Proceed with this problem and its movie in a similar manner.

122

1 Have the children read the problem silently and refer to the movie. Get them to discover the size of the total group by using the ring. Be sure they understand that 18 is divided by 9 because 9 animals are to be put into each box. Be sure the children understand that each ring in the second scene encircles 9 toy animals, the number to be put into each box. Then the answer, 2, represents the number of boxes needed. Ask a pupil to read the text and equation, giving the answers.

2 Proceed in a similar manner for this movie and its text.



1

There are ▢ small cars in the store.
The clerk is going to put them into boxes.
She will put 6 cars into each box.
She will need how many boxes?

Divide 18 by 6. $18 \div 6 = \square$

2

A	$9+9=\square$	E	$18-9=\square$	I	$6\times3=\square$	M	$14\div7=\square$
B	$3\times6=\square$	F	$18\div3=\square$	J	$18\div6=\square$	N	$2\times8=\square$
C	$18\div2=\square$	G	$9\times2=\square$	K	$16\div4=\square$	O	$9+7=\square$
D	$2\times9=\square$	H	$18\div9=\square$	L	$7\times2=\square$	P	$12\div3=\square$

3

Now you should understand how to add and multiply to make 18. You should also understand how to subtract from 18 and how to divide 18.

Using arithmetic

A At a children's zoo the boys and girls saw 5 ducks in one pond and 9 ducks in another pond. How many ducks did they see in all?

B Don saw 10 brown chickens and 8 white ones. He saw how many more brown chickens than white ones?

C Nancy had 9 cents. Mother gave her some more money. Then Nancy had 18 cents. How much money did Mother give her?

D Don had 15 cents, and Mary had 8 cents. Mary had how many fewer cents than Don?

E The children saw 16 rabbits in pens. There were 4 rabbits in each pen. How many pens were there for the rabbits?

F Tom counted 5 beehives, and Don counted 9 beehives. Don counted how many more beehives than Tom?

G Carol saw 4 squirrels, and Nancy saw 6 squirrels. How many squirrels did the two girls see in all?

H The children saw 8 horses at the zoo. Two of them were white. The others were brown. How many of these horses were brown?

123

123

1 Direct the children to read the problem and examine the movie. Let a child tell how many cars are in the total group and in each of the smaller equal groups. Have someone explain what the rings around the smaller equal groups mean. Ask someone to tell how many groups there are in the second scene. Call on a pupil to read the text and the equation and supply the answers.

2 Let the children take turns reading Equations A to P, giving the missing numbers. If you wish, they can also use these exercises as written work.

3 Have a pupil read the statement at the end of the exercise. Then have a child tell what he has learned about 18.

123-124 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving various types of verbal problems. He uses principles of the number system as related to money.

Vocabulary

New words page 123 zoo; page 124 stories*

Comments

Handle the problems in "Using arithmetic" in the usual way. Remind the pupils that in some addition problems the equation may be written in two ways because it makes no difference which group is imagined as joining the other group.

In "Thinking straight" the child applies his knowledge of the number system to money. The section also requires him to apply his knowledge of the equivalent values of coins. Children enjoy exercises of this type because of their appeal to the puzzle interest.

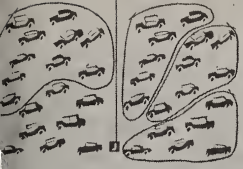
Answers

Using arithmetic:

A $5+9=[14]$ or $9+5=[14]$
B $10-8=[2]$
C $9+[9]=18$
D $15-8=[7]$
E $16\div4=[4]$
F $9-5=[4]$
G $4+6=[10]$ or $6+4=[10]$
H $8-2=[6]$
I $12-3=[9]$
J $5-2=[3]$
K $3\times6=[18]$
L $14\div7=[2]$
M $4\times3=[12]$
N $8+9=[17]$ or $9+8=[17]$
O $2\times9=[18]$
P $15-6=[9]$

Thinking straight:

A The money that the 9 stands for
B The money that the 1 stands for
C 20 pennies
D Yes
E Yes
F 1 half dollar and 1 nickel
G 1 half dollar, 2 dimes, 1 nickel, 2 pennies
H 3 dimes, 3 pennies
I 5 groups
J 5 pennies; 2 groups



There are ▪ small cars in the store.
The clerk is going to put them into boxes.
She will put 6 cars into each box.
She will need how many boxes?

Divide 18 by 6. 18 ÷ 6 = ▪

A 9 + 9 = ▪
B 3 × 6 = ▪
C 18 ÷ 2 = ▪
D 2 × 9 = ▪
E 18 − 9 = ▪
F 18 ÷ 3 = ▪
G 9 × 2 = ▪
H 18 ÷ 9 = ▪
I 6 × 3 = ▪
J 18 ÷ 6 = ▪
K 16 ÷ 4 = ▪
L 7 × 2 = ▪
M 14 ÷ 7 = ▪
N 2 × 8 = ▪
O 9 + 7 = ▪
P 12 ÷ 3 = ▪

Now you should understand how to add and multiply to make 18. You should also understand how to subtract from 18 and how to divide 18.

Using arithmetic 1

A At a children's zoo the boys and girls saw 5 ducks in one pond and 9 ducks in another pond. How many ducks did they see in all? 2

B Don saw 10 brown chickens and 8 white ones. He saw how many more brown chickens than white ones?

C Nancy had 9 cents. Mother gave her some more money. Then Nancy had 18 cents. How much money did Mother give her?

D Don had 15 cents, and Mary had 8 cents. Mary had how many fewer cents than Don?

E The children saw 16 rabbits in pens. There were 4 rabbits in each pen. How many pens were there for the rabbits?

F Tom counted 5 beehives, and Don counted 9 beehives. Don counted how many more beehives than Tom?

G Carol saw 4 squirrels, and Nancy saw 6 squirrels. How many squirrels did the two girls see in all? 2

H The children saw 8 horses at the zoo. Two of them were white. The others were brown. How many of these horses were brown?

123

I The children counted 12 sheep in a field. Three sheep were black, and the rest were white. How many sheep were white?

J Mary saw 5 white lambs and 3 black lambs in a field. She saw how many fewer black lambs than white lambs in the field?

K Dick saw 3 groups of books of animal stories on a table at the zoo. There were 6 books in each group. How many books were on the table?

L Don counted 14 birds in cages. Seven birds were in each cage. There were how many cages for the birds?

M Carol said, "I see 4 groups of little black bears. There are 3 bears in each group." How many little black bears did Carol see?

N Don said, "There are 8 pigs in one pen and 9 pigs in another pen." There were how many pigs in the two pens? 1

O Nancy said, "I see two groups of chickens. There are 9 chickens in each group." How many chickens did Nancy see?

P Betty gave 6 of her 15 pictures of zoo animals to Ann. How many pictures of zoo animals did Betty keep? 2

Thinking straight

In 91¢, which is more, the money that the 9 stands for or the money that the 1 stands for? 3

In 19¢, which is more, the money that the 9 stands for or the money that the 1 stands for?

In 25¢, what 20 coins could the 2 stand for?

Could the 2 in 25¢ stand for nickels?

Could the 5 in 25¢ stand for a nickel?

F In 55¢, what 2 coins could the 2 fives stand for?

G In 77¢, what 6 coins could the 2 sevens stand for?

H In 33¢, what 6 coins could the 2 threes stand for?

I In 12¢, the 2 stands for 2 pennies. The pennies that the 1 stands for would make ▪ groups of 2 pennies.

J In 15¢, the 5 stands for ▪ pennies. The pennies that the 1 stands for would make ▪ groups of 5 pennies.

123

1 Have the children work independently on these problems without previous discussion. Children should read each problem and write an equation for it, using a screen or square for the missing number. Then they should rewrite the equation, supplying the answer.

2 Note that in this problem either of two equations is equally acceptable.

124

1 Note that in this problem either of two equations is equally acceptable.

2 When the children have finished, allow time for them to check their answers. If any children have had trouble, give individual help or group the children so that they can help one another.

3 Use these exercises orally. Be prepared for discussion as the pupils take turns in giving answers. Allow each child to explain his answer if any of the other pupils disagree with him.

125 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child takes tests on all the basic facts for the four processes for groups 11 to 18 (the basic facts whose sums, minuends, products, and dividends are 11 to 18).

Vocabulary

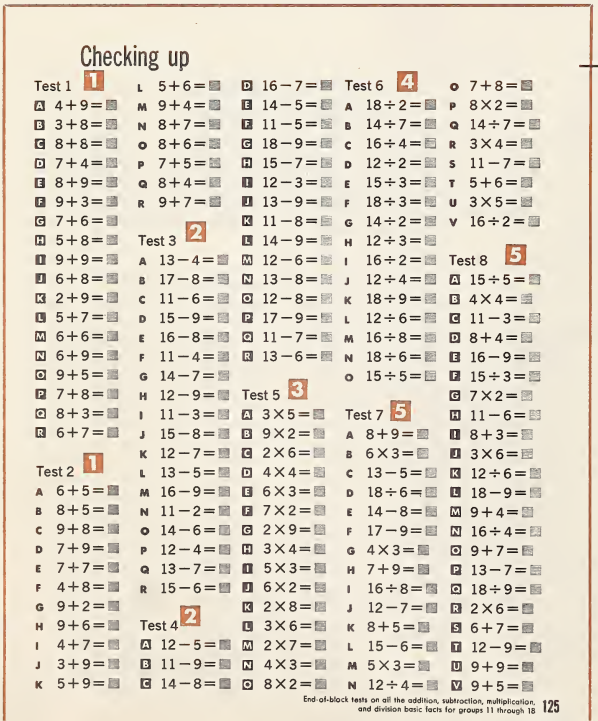
No new words are introduced on this page.

Comments

These are not speed tests. You should give the children ample time to complete their work.

On these tests you should hope for correct answers for all the basic facts, not just some of them. This is because no child can succeed in computation unless and until he knows all the basic facts. The arrangement of the tests makes it possible to evaluate quickly each child's knowledge of the basic facts, and if any pupil is found deficient, immediate reteaching should be undertaken before he goes on. Pages 66-70, 79-82, 94-102, and 104-123 may be used for reteaching.

Use as many of the 8 tests during one class period as you feel are advisable for your particular group of children. Tell your pupils to copy on their papers the labeling letter for each basic fact and write the answer after it. If you prefer, the children may write the completed equation.



Checking up

Test 1 [1]

A 4+9=
B 3+8=
C 8+8=
D 7+4=
E 8+9=
F 9+3=
G 7+6=
H 5+8=
I 9+9=
J 6+8=
K 2+9=
L 5+7=
M 6+6=
N 6+9=
O 9+5=
P 7+8=
Q 8+3=
R 6+7=

Test 2 [1]

A 6+5=
B 8+5=
C 9+8=
D 7+9=
E 7+7=
F 4+8=
G 9+2=
H 9+6=
I 4+7=
J 3+9=
K 5+9=
L 5+6=
M 9+4=
N 8+7=
O 8+6=
P 7+5=
Q 8+4=
R 9+7=

Test 3 [2]

A 13−4=
B 17−8=
C 11−6=
D 15−9=
E 16−8=
F 11−4=
G 14−7=
H 12−9=
I 11−3=
J 15−8=
K 12−7=
L 13−5=
M 16−9=
N 11−2=
O 14−6=
P 12−4=
Q 13−7=
R 15−6=

Test 4 [2]

A 12−5=
B 11−9=
C 14−8=
D 16−7=
E 14−5=
F 11−5=
G 18−9=
H 15−7=
I 12−3=
J 13−9=
K 11−8=
L 14−9=
M 12−6=
N 13−8=
O 12−8=
P 17−9=
Q 11−7=
R 13−6=

Test 5 [3]

A 3×5=
B 9×2=
C 2×6=
D 4×4=
E 6×3=
F 7×2=
G 2×9=
H 3×4=
I 5×3=
J 6×2=
K 2×8=
L 3×6=
M 2×7=
N 4×3=
O 8×2=

Test 6 [4]

A 18÷2=
B 14÷7=
C 16÷4=
D 12÷2=
E 15÷3=
F 18÷3=
G 14÷2=
H 12÷3=
I 16÷2=
J 12÷4=
K 18÷9=
L 12÷6=
M 16÷8=
N 18÷6=
O 15÷5=

Test 7 [5]

A 8+9=
B 6×3=
C 13−5=
D 18÷6=
E 14−8=
F 17−9=
G 4×3=
H 7+9=
I 16÷8=
J 12−7=
K 8+5=
L 15−6=
M 5×3=
N 12÷4=
O 7+8=
P 8×2=
Q 14÷7=
R 3×4=
S 11−7=
T 5+6=
U 3×5=
V 16÷2=

Test 8 [5]

A 15÷5=
B 4×4=
C 11−3=
D 8+4=
E 16−9=
F 15÷3=
G 7×2=
H 11−6=
I 8+3=
J 3×6=
K 12÷6=
L 18−9=
M 9+4=
N 16÷4=
O 9+7=
P 13−7=
Q 18÷9=
R 2×6=
S 6+7=
T 12−9=
U 9+9=
V 9+5=

End-of-block tests on all the addition, subtraction, multiplication, and division basic facts for groups 11 through 18

125

125

1. Tests 1 and 2 contain the addition basic facts for groups 11 to 18.
2. Tests 3 and 4 contain the subtraction basic facts for groups 11 to 18.
3. Test 5 contains the multiplication basic facts for groups 12, 14, 15, 16, and 18.
4. Test 6 contains the division basic facts for groups 12, 14, 15, 16, and 18.
5. Tests 7 and 8 contain a mixed selection of the basic facts for groups 11 to 18.

126-127 Exploring problems

Exponded Notes for this lesson ore on pages 267-268.

Objectives

The child learns to determine the size and number of equal groups in multiplicative situations where objects are not definitely described as "groups."

Vocabulary

New words **page 126** bars; **page 127** paid*, pay*, chairs*, apiece

Comments

Up to now the children have studied multiplicative situations in which groups of objects have been plainly identified as groups: "Billy put 4 *groups* of cars into a box. There were 2 cars in each *group*. How many cars were put in the box?" Children could see or count the number of groups and the size of the group.

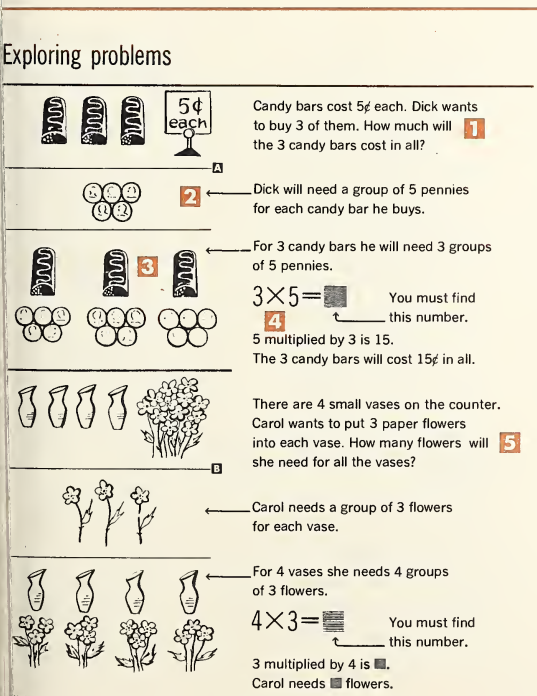
To progress in problem solving, children need to learn how to solve problems where the number of groups is often not definitely stated in the problem situation. For example: "Candy bars cost 5¢ each. Dick wants to buy 3 of them. How much will 3 candy bars cost?" Here the child *thinks* of a group of 5 pennies as matched with each candy bar. He sees that 3 groups of 5 pennies are needed to pay for the 3 candy bars. Children need experience with this type of situation in order to "round out" their understanding of the uses of multiplication. The material on pages 126 and 127, consisting of pictures, explanations, and problems, has been designed to help children acquire this experience.

In working with the problems without illustrations, be sure to ask questions that lead the children to identify the groups. Ask questions like these: "What objects should you think of in *groups*? How do you know how many groups you will have?"

Answers

Page 127:

E $4\times4=[16]$	G $2\times4=[8]$	I $7\times2=[14]$
F $8\times2=[16]$	H $2\times8=[16]$	J $2\times9=[18]$


Exploring problems
5¢ each
Candy bars cost 5¢ each. Dick wants to buy 3 of them. How much will the 3 candy bars cost in all? 1
A
2
Dick will need a group of 5 pennies for each candy bar he buys.
3
For 3 candy bars he will need 3 groups of 5 pennies.
3×5=■
You must find this number.
4
5 multiplied by 3 is 15.
The 3 candy bars will cost 15¢ in all.
There are 4 small vases on the counter. Carol wants to put 3 paper flowers into each vase. How many flowers will she need for all the vases? 5
B
Carol needs a group of 3 flowers for each vase.
For 4 vases she needs 4 groups of 3 flowers.
4×3=■
You must find this number.
3 multiplied by 4 is ■.
Carol needs ■ flowers.

Understanding what determines the size of the equal groups and the number of equal groups in multiplication situations

126

1 Direct pupils to read the three lines of the problem and to look at the picture opposite to see the things mentioned.

2 Have pupils read the statement opposite this arrow. Relate the statement to the picture.

3 Tell pupils to look at this picture. Get them to observe that a group of 5 pennies has been put with each of the 3 candy bars. Pupils should conclude that this has been done because the candy bars cost 5¢ each. Ask how many groups there are and how many pennies are in each group. Ask how they can find out how many there are in all. Help them see that this amount is the cost of 3 candy bars.

4 Have pupils look at this equation and relate it to the picture. Be sure they understand that the 3 stands for the number of groups and the 5 stands for the size of each group. Have someone read the two statements.

5 Treat this problem, the pictures, and the explanations in a similar way.

A Tom put some toy cars into 2 boxes. He put 5 cars into each box. How many toy cars in all did he put into the boxes? 1

Number of equal groups.
Number in each group.
Number in all.
$2 \times 5 = \square$ You must find this number.

5 multiplied by 2 = ▪
2 × 5 = ▪

B Carol had 6 small bags of cookies. 3 cookies were in each bag. How many cookies were in all the bags? 2

Number of equal groups.
Number in each group.
Number in all.
$6 \times 3 = \square$ You must find this number.

3 multiplied by 6 = ▪
6 × 3 = ▪

C Betty paid 6¢ apiece for 2 bags of popcorn. How much did she pay altogether for the popcorn?

THINK There are ▪ pennies in each group. 3
2 × 6 = ▪

D Nancy bought 3 bags of oranges. There were 6 oranges in each bag. How many oranges did she buy in all?

THINK There are ▪ oranges in each group. 3
3 × 6 = ▪

E Four children ate all the cookies Mother made. Each child ate 4 cookies. How many cookies did Mother make? 4

F Mary bought 8 pages of paper dolls. Each page had 2 dolls on it. How many paper dolls did she buy?

G Don bought 2 boxes of toy circus animals. There were 4 animals in each box. How many animals were in the 2 boxes?

H May bought 2 dollhouse chairs. She paid 8¢ for each chair. How much did she pay for the chairs?

I Jack paid 2¢ apiece for 7 candy sticks. How much did he pay in all for the candy sticks?

J Ellen took 2 bunches of flowers to school. There were 9 flowers in each bunch. How many flowers did Ellen take to school? 5

Sometimes when you multiply, the number of equal groups is the number of things you are going to buy, the number of boxes you will use, and so on.

127

127

1 Have a pupil read this problem aloud. Then draw attention to the equation and relate it to the problem. Be sure the children understand that the 2 stands for the number of equal groups (the 2 boxes) and the 5 stands for the size of each equal group (number of cars in each box). Ask a pupil to read the equation, supplying the missing number.

2 Use Note 1 in dealing with this problem.

3 Draw attention to the "Think" statement and explain that such a statement is designed to help the children understand what the problem is about. Be sure they understand clearly which number in the equation stands for the size of the group and which number stands for the number of groups.

4 Let the class work independently on Problems E to J, writing a complete equation for each.

5 When the children have finished, allow them to check their work. Give individual help where it seems necessary.

128-129 Moving forward

Expanded Notes for this lesson are on pages 268-269.

Objectives

The child learns why in measurement he must multiply to change to a smaller unit and why he must divide to change to a larger unit. He also practices basic facts.

Vocabulary

There are no new words in this lesson.

Comments

In measurement, to change to a smaller unit, children have been taught, traditionally, simply to "multiply." Likewise, in changing to a larger unit, children have been told to "divide." Many children have not understood why these processes should be used, and the rules have been easily forgotten or interchanged. The work on pages 128 and 129 helps make clear why these processes are used to make the desired changes.

On page 128 in the first problem a unit of measurement is changed to a smaller unit (quarts to pints). Accompanying illustrations show that this becomes a case of finding the total when equal groups are combined. Children have already learned that one quart is equal to two pints. Using this fact, they see that the number of larger units (quarts) determines the number of equal groups, and that the size of the groups is determined by the number of smaller units (pints) that corresponds to each of the quarts. Thus in this particular problem the situation is multiplicative.

In the second problem a smaller unit is changed to a larger unit. Accompanying illustrations show that here the problem requires the finding of the number of equal groups. Knowing that two pints are equal to one quart, pupils see the pints separated into groups of two and a quart matched to each group. Counting the number of groups gives the answer. They know also that such separating into equal groups is a divisive situation.

Page 129 provides for practice without illustrations in changing to larger and smaller units. A "Keeping skillful" exercise gives practice on the basic facts.

Moving forward

In this lesson you will learn more about measures.

1 On Saturday Mother bought 4 quarts of milk. The milk she bought was equal to how many pints?

A

Think of each quart as equal to a group of 2 pints. **2**

3 Four quarts are equal to 4 groups of 2 pints.

$4 \times 2 = \square$ You must find this number.

2 multiplied by 4 is 8.
The 4 quarts of milk are equal to 8 pints.

10 pints of milk are in a store.
This milk is equal to how many quarts?

B

4 A group of 2 pints is equal to 1 quart.

Think of the 10 pints in groups of 2.

$10 \div 2 = \square$ You must find this number. **5**

10 divided by 2 is ■.
The 10 pints of milk are equal to ■ quarts.

A 6 yards = ■ feet **1**

Number of equal groups.
Number in each equal group.
Number in all.

$6 \times 3 = \square$ You must find this number.

$6 \times 3 = \square$
6 yards are equal to ■ feet.

B 14 pints = ■ quarts **2**

Number in all.
Number in each equal group.
Number of equal groups.

$14 \div 2 = \square$ You must find this number.

$14 \div 2 = \square$
14 pints are equal to ■ quarts.

C 12 feet = ■ yards **3**
$12 \div 3 = \square$

D 2 gallons = ■ pints
$2 \times 8 = \square$

E 16 quarts = ■ gallons
F 16 pints = ■ gallons
G 3 yards = ■ feet
H 18 feet = ■ yards
I 12 quarts = ■ gallons
J 4 yards = ■ feet
K 8 quarts = ■ gallons
L 12 pints = ■ quarts
M 9 feet = ■ yards
N 3 gallons = ■ quarts
O 5 yards = ■ feet
P 7 quarts = ■ pints
Q 6 feet = ■ yards
R 2 gallons = ■ quarts
S 4 gallons = ■ quarts
T 18 pints = ■ quarts

Now you should understand why 14 pints are equal to 7 quarts, why 6 yards are equal to 18 feet, and so on.

Keeping skillful **4**

A	Divide 18 by 9.	I	$6 \times 3 = \square$	A	$5 + 9 = \square$	I	$4 + 5 = \square$
B	Subtract 8 from 17.	J	$15 - 8 = \square$	B	$2 \times 9 = \square$	J	$11 - 6 = \square$
C	Add 6 to 9.	K	$16 \div 2 = \square$	C	$15 \div 5 = \square$	K	$3 \times 3 = \square$
D	Multiply 4 by 4.	L	$9 + 9 = \square$	D	$17 - 9 = \square$	L	$8 \div 4 = \square$
E	Multiply 6 by 3.	M	$8 + 6 = \square$	E	$14 - 6 = \square$	M	$13 - 8 = \square$
F	Subtract 5 from 14.	N	$2 \times 7 = \square$	F	$2 \times 8 = \square$	N	$8 + 9 = \square$
G	Divide 16 by 8.	O	$16 \div 4 = \square$	G	$9 + 8 = \square$	O	$5 + 5 = \square$
H	Add 7 to 9.	P	$18 - 9 = \square$	H	$18 \div 6 = \square$	P	$12 \div 3 = \square$

128

1 Have children read the problem and note the 4 quarts in the picture opposite.

2 Tell pupils to read this sentence and look at the picture at the left. Point out that the quart bottle is dimmed off because the two pints are thought of as taking its place.

3 Ask pupils to read the first sentence of this section and to look at the 4 groups of 2 pints in the picture. Be sure they see and understand the dimming off of the quart bottles. Have someone read the equation and relate the numbers to the number of equal groups and the size of each group.

4 In this picture the children should observe that the two pints are dimmed off because one quart (their equivalent) is replacing them.

5 The children should observe that each dimmed-off group of two pints is matched by one quart. This recognition should lead to the discovery that the number of quarts can be found by thinking of the pints in groups of two.

129

1 Ask children to read the first line. Then ask how many feet are in 1 yard. Have them look at the equation. Make clear that the 6 stands for the number of equal groups and that the 3 stands for the size of each group because 3 feet equal 1 yard. Have someone read the last two lines, putting in the missing number.

2 Have pupils read the first line and direct attention to the equation. Get the children to identify the number that stands for the total number of pints. Be sure they understand that the 2 stands for the size of each equal group because 2 pints equal 1 quart and that we can think of the 14 quarts as divided into groups of 2 pints each. Ask someone to read and complete the equation.

3 Let pupils take turns reading and answering these exercises.

4 As a separate lesson, you may have pupils write equations with answers for Exercises A to H, and answers only for the rest.

130-133 Moving forward

Exponded Notes for this lesson ore on pages 270-272.

Objectives

The child learns that in adding two numbers he can increase either number by the other one and get the same total. In multiplying, he learns that he can use either number as the multiplier and get the same product. He learns that there is an inverse relationship between addition and subtraction and between multiplication and division.

Vocabulary

New words **page 130** cats*; **page 133** either

Comments

When imagined action was introduced in connection with the 11 group, it became possible to teach a basic fact and its reverse (8+3=11 and 3+8=11) at the same time. This became possible because, with imagined action, either of the two groups can be thought of as joining the other. At this point, then, children began to realize that changing the order of addends does not affect the resulting total group. By the time children have reached page 130, they probably will have some understanding of this principle. The work on page 130 will bring it sharply into focus. However, do not be disturbed if children cannot always state the reverse of a given basic fact.

The work on page 131 does for multiplication what page 130 does for addition. It shows that in multiplication, so far as the product is concerned, the order of factors is not important.

On page 132 pupils learn about the relationship between addition and subtraction. They learn that when the number added is taken away from the total, the number they started with will be left. In other words, they learn that what can be put together additively can be taken apart subtractively, that 8+5=13 and 13−5=8, for example. Selecting the correct inverse basic facts will be hard for some children. That is, if a child is given the basic fact 3+7=10 and asked to give the inverse, he may say 10−3, rather than 10−7. Do not be disturbed by this.

The relationship between multiplication and division is presented on page 133.

Answers

Answers are given only for the reverse and inverse basic facts.

Page 130:

B 8+3=11
C 7+9=16
D 9+5=14
E 3+9=12
F 8+5=13
G 3+7=10
H 8+9=17

Page 131:

B 4×3=12
C 3×5=15
D 9×2=18
E 2×4=8
F 6×2=12
G 5×2=10
H 2×7=14
I 6×3=18
J 2×8=16
K 5×3=15
L 4×2=8
M 2×6=12

Page 132:

(block 1)

F 17−9=8
G 16−9=7
H 14−5=9
I 13−7=6
J 11−9=2
K 11−7=4
L 18−9=9

(block 2)

A 17−8=9
B 13−9=4
C 9−6=3
D 11−6=5
E 12−5=7
F 14−8=6
G 9−1=8
H 12−9=3
I 10−1=9
J 14−7=7
K 12−7=5
L 14−9=5

Page 133:

(block 1)

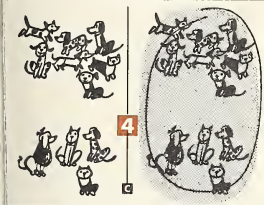
D 12÷4=3
E 18÷3=6
F 12÷6=2
G 8÷2=4
H 18÷9=2
I 4÷2=2
J 12÷2=6
K 16÷8=2
L 18÷2=9

(block 2)

A 10÷2=5
B 18÷2=9
C 14÷2=7
D 15÷5=3
E 16÷2=8
F 8÷4=2
G 6÷2=3
H 12÷2=6
I 16÷4=4
J 6÷3=2
K 14÷7=2
L 15÷3=5

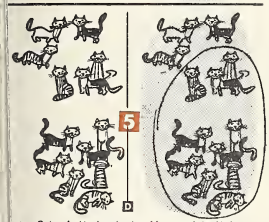
Moving forward

In this lesson you will learn some new things about adding, subtracting, multiplying, and dividing.



3

A 5 boys + 4 boys = ▢ boys
5 + 4 = ▢
B 4 boys + 5 boys = ▢ boys
4 + 5 = ▢
C 7 dogs + 4 dogs = ▢ dogs
7 + 4 = ▢
4 dogs + 7 dogs = ▢ dogs
4 + 7 = ▢
D 6 cats + 7 cats = ▢ cats
6 + 7 = ▢
7 cats + 6 cats = ▢ cats
7 + 6 = ▢



6

A 8 + 7 = 15 7 + 8 = 15
B 3 + 8 = 11 ▢ + ▢ = 11
C 9 + 7 = 16 ▢ + ▢ = 16
D 5 + 9 = 14 ▢ + ▢ = 14
E 9 + 3 = ▢ ▢ + ▢ = 12
F 5 + 8 = ▢ ▢ + ▢ = 13
G 7 + 3 = ▢ ▢ + ▢ = 10
H 9 + 8 = ▢ ▢ + ▢ = 17

2

A 3 groups of 4 ponies = ▢ ponies
3 × 4 = ▢
B 4 groups of 3 ponies = ▢ ponies
4 × 3 = ▢
C 3 groups of 6 cats = ▢ cats
3 × 6 = ▢
D 6 groups of 3 cats = ▢ cats
6 × 3 = ▢

4

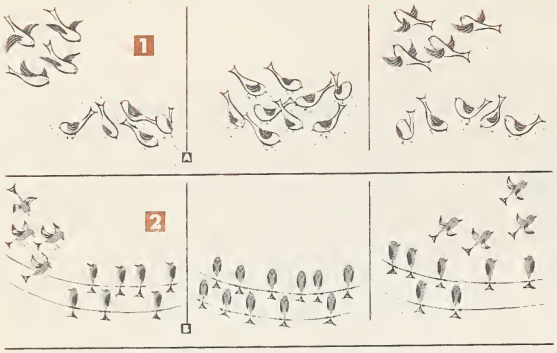
A 3 × 2 = ▢ 2 × 3 = 6
B 3 × 4 = ▢ ▢ × ▢ = 12
C 5 × 3 = ▢ ▢ × ▢ = 15
D 2 × 9 = ▢ ▢ × ▢ = 18
E 4 × 2 = ▢ ▢ × ▢ = 8
F 2 × 6 = ▢ ▢ × ▢ = 12
G 2 × 5 = ▢ ▢ × ▢ = 10
H 7 × 2 = ▢ ▢ × ▢ = 14
I 3 × 6 = ▢ ▢ × ▢ = 18
J 8 × 2 = ▢ ▢ × ▢ = 16
K 3 × 5 = ▢ ▢ × ▢ = 15
L 2 × 4 = ▢ ▢ × ▢ = 8
M 6 × 2 = ▢ ▢ × ▢ = 12

130

1. Have the children examine the three scenes of Movie A. Get them to determine the number of boys in each group and note that the group of 4 boys is joining the group of 5 boys in the second scene. They should observe the size of the total group in the last scene.
2. Proceed similarly for Movie B, but get the children to observe that here the group of 5 boys is joining the group of 4 boys.
3. Tell pupils to find and complete the statements and equations that describe the actions shown in Movies A and B.
4. Let pupils decide what is shown in these two scenes. Have them read statements and equations that match what is shown in Movie C.
5. Use Note 4 for Movie D.
6. Explain that Exercise A shows that the answer (15) is the same whether we add 7 to 8 or 8 to 7. Have pupils take turns reading the first equation (completing it where necessary) and then supplying the reverse basic fact.

131

1. Tell the children to look at Movies A and B. They should observe how the actions differ [Movie A shows 3 groups of 4 combining, Movie B shows 4 groups of 3 combining]. They should also note that the resulting total is the same in both cases.
2. Direct the children to find and read the statements and equations that show the actions of Movies A and B. Have pupils supply the missing numbers.
3. Get children to observe that the first scene of Movie C shows three groups of six, while the first scene of Movie D shows six groups of three. Pupils should find and complete the statements and equations that match these movies.
4. Deal with these basic facts and their reverses in a way similar to that outlined for addition on page 130.



A 5 birds plus 4 birds = ▢ birds
5+4=▢
9 birds minus 4 birds = ▢ birds
9−4=▢

B 7 birds plus 4 birds = ▢ birds
7+4=▢
11 birds minus 4 birds = ▢ birds
11−4=▢

A	8+5=▢	3	13−5=▢	A	9+8=▢	▢−▢=▢
B	7+8=▢		15−8=▢	B	4+9=▢	▢−▢=▢
C	3+7=▢		10−7=▢	C	3+6=▢	▢−▢=▢
D	9+6=▢		15−6=▢	D	5+6=▢	▢−▢=▢
E	2+7=▢		9−7=▢	E	7+5=▢	▢−▢=▢
F	8+9=▢		▢−▢=▢	F	6+8=▢	▢−▢=▢
G	7+9=▢		▢−▢=▢	G	8+1=▢	▢−▢=▢
H	9+5=▢		▢−▢=▢	H	3+9=▢	▢−▢=▢
I	6+7=▢		▢−▢=▢	I	9+1=▢	▢−▢=▢
J	2+9=▢		▢−▢=▢	J	7+7=▢	▢−▢=▢
K	4+7=▢		▢−▢=▢	K	5+7=▢	▢−▢=▢
L	9+9=▢		▢−▢=▢	L	5+9=▢	▢−▢=▢

132

A 4 groups of 3 birds = ▢ birds
4×3=▢
12 birds ÷ 3 = ▢ groups of birds
12÷3=▢

B 2 groups of 5 birds = ▢ birds
2×5=▢
10 birds ÷ 5 = ▢ groups of birds
10÷5=▢

A	2×7=▢	3	14÷7=▢	A	5×2=▢	▢÷▢=▢
B	3×6=▢		18÷6=▢	B	9×2=▢	▢÷▢=▢
C	5×3=▢		15÷3=▢	C	7×2=▢	▢÷▢=▢
D	3×4=▢		▢÷▢=▢	D	3×5=▢	▢÷▢=▢
E	6×3=▢		▢÷▢=▢	E	8×2=▢	▢÷▢=▢
F	2×6=▢		▢÷▢=▢	F	2×4=▢	▢÷▢=▢
G	4×2=▢		▢÷▢=▢	G	3×2=▢	▢÷▢=▢
H	2×9=▢		▢÷▢=▢	H	6×2=▢	▢÷▢=▢
I	2×2=▢		▢÷▢=▢	I	4×4=▢	▢÷▢=▢
J	6×2=▢		▢÷▢=▢	J	2×3=▢	▢÷▢=▢
K	2×8=▢		▢÷▢=▢	K	2×7=▢	▢÷▢=▢
L	9×2=▢		▢÷▢=▢	L	5×3=▢	▢÷▢=▢

Now you see that when you multiply and add, you can write either number first.

133

132

1 Direct attention to Movie A and get the children to observe that the number added in the first scene is the same as the number going away in the third scene. Tell them to read the statements and equations in Exercise A and relate them to the three scenes of the movie.

2 Proceed in a similar way for Movie B and Exercise B.

3 Note that the inverse basic fact is given for each of the first five exercises. You may use these exercises for oral work, with the pupils taking turns in supplying the equation for the inverse basic fact and its answer, or you may have pupils write the inverse equations on their papers. Work for understanding that the number added in the first equation is the one to be subtracted in the second equation.

133

1 Tell pupils to look at Movie A. Get them to observe the combining of equal groups in the first scene and the separating of the total into the same equal groups in the third scene. Have Exercise A read and relate it to the three scenes of the movie.

2 Proceed similarly for Movie B and Exercise B.

3 In working with these exercises, strive for understanding that the number multiplied in each basic fact given becomes the divisor in its inverse. You may use these exercises as oral or as written work, or both.

134-138 Exploring problems

Expanded Notes for this lesson are on pages 272-274.

Objectives

The child learns how to find the size of equal groups when the whole group and the number of groups are known (partitive division).

Vocabulary

New words **page 134** share; **page 136** tablets, Jim*; **page 137** up*, pencils; **page 138** if*, team

Comments

Up to this time the child has studied only divisive situations in which he knows the size of the equal groups and is to find the number of equal groups. This type of situation was used to introduce the division basic facts. There is, however, another type of divisive situation in which the child does not know how many are in the equal groups, but he does know the number of groups. This type is most familiar, perhaps, in situations in which things are shared equally among a group of people and in which a certain number of objects is bought for a specified sum of money.

This lesson introduces the new type of divisive situation and helps the child build up the proper equation for solving this type of problem. An equation for solving this type of division problem might be, for example, 12÷▒=3, where 12 stands for the number of objects. The child learns why the screen for the unknown number goes out after the division sign, not after the equals sign. This is because the number of objects in the equal groups is the number he does not know. Through pictures and explanations in the text the child learns why he can divide 12 by 3 to get the answer.

The traditional treatment of this type of divisive situation has sidestepped a very important fact. The child has been taught to divide by using the number of objects in a group as the divisor. He must now be taught how we can continue to use as a divisor a number that represents objects per group. Thus, when we are dealing with the equation 12÷▒=3, suppose the 12 represents the number of chocolates that are to be divided among 3 children. To conform to what has been taught, we must divide by another number that represents the size of a group of chocolates. The size of this group is the same as the number of children. The 3 we divide by stands for the size of the group of chocolates that is formed when each child has taken one chocolate.

The method of solving problems of this type will be clearer to pupils if they act out the situation with real objects. For example, have 12 objects, and let three children participate. Tell each child to take one object, and then help the pupils to see that they have taken away a group of 3. Have them repeat this activity, and be sure they observe that a group of 3 is being taken away each round until all the objects have been taken away. Help them see that when the whole group is divided into equal groups of 3 this is a division problem of the type they are accustomed to and they should know the answer (4). They can check this answer by looking at the total number of objects each child gets. Activities of this type should thoroughly impress on children the correct method of solving the new type of divisive situation.

It is important that children understand this concept. Some teachers may be confused by it and feel that it is relatively unimportant, but they should remember that children will be able to see the principle more readily than many adults who have learned division in only a rote manner.

Answers

Exploring problems

Page 138:

Note that the brackets indicate the position of the screen for the unknown number, and the numbers within brackets are those that the children are required to find.

D $16 \div [4] = 4$
E $6 \div [3] = 2$
F $10 \div [2] = 5$
G $2 \times 4¢ = [8¢]$
H $12 \div [3] = 4$
I $14 \div [7] = 2$
J $16 \div [2] = 8$
K $2 \times 8 = [16]$
L $14 \div 7 = [2]$
M $10 \div [5] = 2$
N $15 \div [3] = 5$

see

A

Tom, Ann, and Carol are going to share 12 chocolates. Each child is going to take the same number of chocolates. How many chocolates will each child get? 1

There are 12 chocolates in all. 2

12 ← Number of chocolates in all

3

B

The children are dividing the candy into equal groups. You do not know how many chocolates will be in each group.

$12 \div \square$ ← Number of chocolates in each group

C

There will be as many equal groups of chocolates as there are children. 4 You know that there will be 3 equal groups of chocolates because there are 3 children.

$12 \div \square = 3$ ← Number of equal groups; ← You must find this number.

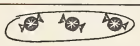
134 Finding the size of the equal groups when the whole group and the number of groups are known (partitive division)

compute

1

D

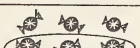
There are 12 chocolates in all.



E

Now each child has taken 1 chocolate. The children have taken a group of 3 chocolates.

2



F

Each child has taken another chocolate. They have taken another group of 3 chocolates.

3

G

The children have taken another group of 3 chocolates.

4

H

Each time the children took 1 chocolate apiece, they took a group of 3 chocolates. So you can think of the 12 chocolates as divided into groups of 3.

12 divided by 3 = 4

4

Now turn the page.

134

1 Tell the children to read this problem. Point out that the three children in the picture are going to share the chocolates equally.

2 Have the statement opposite the arrow read by a pupil. Direct attention to the large numeral 12 and the statement opposite it.

3 Point out that in Picture B the children are beginning to share the chocolates. Have the sentence opposite the arrow read and direct attention to the expression "$12 \div \square$." Be sure the children understand that the screen stands for the number of chocolates each child will have.

4 Give special attention to these two sentences which explain what the 3 stands for. The 3 stands for the number of equal groups. This is, of course, the same as the number of children. Tell the class to look at the equation and its accompanying statements. Then direct them to go on to the next page.

135

1 Have children look at this picture and identify the group of 12.

2 Tell the children to imagine that Tom, Ann, and Carol have each taken one chocolate. Identify the chocolate on the left as Carol's, the middle one as Ann's, and the one on the right as Tom's. Get the children to note that a group of three chocolates has been taken.

3 Again tell the children to imagine that Tom, Ann, and Carol have each taken another chocolate. Note, too, that another group of three has been taken.

4 Proceed in the same manner through Pictures G and H. The children should observe the repetitive nature of the action—that is, each time the children take one chocolate, a new group of three is formed and set aside. In the last picture, the pupils should note that all the chocolates have been taken.

Each child took 4 chocolates.

I

$12 \div \square = 3$

You now know that to find this number you divide 12 by 3.

2

J

$12 \div \square = 3$

This number is 4, because the chocolates are divided into groups of 4.

3

Each child will get 4 chocolates.

see

A

Jim has 18 paper tablets. He is dividing them equally with Bill. How many tablets should each boy get?

4

B

Number of tablets in all.

Number of tablets in each group.

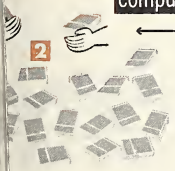
$18 \div \square = 2$

Number of equal groups of tablets.

You must find this number.

5

compute



C

Each time the boys take 1 tablet apiece, they take a group of 2 tablets. How many groups of 2 tablets must they take to use up all the tablets?

1

$18 \div \square = 2$

To find this number, you divide 18 by what number?

3

D

$18 \div \square = 2$

This number is ■, because 18 divided by 2 is ■.

4

Each boy should get ■ tablets.

lary made 15 dresses for 3 dolls. nade each doll the same number esses. How many dresses did she for each doll?

umber in all.

6

Number in each group.

Number of equal groups.

$\square \div \square = 3$

You must find this number.

15 by 3.

ade ■ dresses for each doll.

B Dick paid 16¢ for 2 pencils of the same kind. The pencils cost how many cents apiece?

THINK 16¢ = how many pennies? How many equal groups of pennies did Dick spend? Find how many pennies there were in each equal group.

$16 \div \square = 2$ Divide 16 by 2.

C Ann paid 9¢ for 3 toy animals of the same kind. How much did each toy animal cost?

$9 \div \square = 3$ Divide 9 by 3.

136

1 When the children look at this picture, tell them that the candy on the left is Carol's, the candy in the middle is Ann's, and the candy on the right is Tom's. They should observe that each child took four chocolates.

2 Direct attention to the equation and the statement beside it. Explain that to find the missing number, we can divide 12 by 3 because 3 stands for the number of chocolates the children took each time.

3 Have a pupil read the statement beside the arrow and relate it to Picture J.

4 Tell pupils to read Problem A and look at the picture. Be sure they understand that because two boys are sharing the tablets equally there will have to be two equal groups of tablets.

5 Be sure the children understand what the 18, the screen, and the 2 stand for in this equation. Remind them again that there must be two equal groups of tablets.

137

1 Ask pupils to read these four lines.

2 Ask them to look at the picture. Get them to observe that each time a boy takes a tablet a group of two tablets is formed and set aside. Let them name the boy they think each tablet belongs to.

3 Have pupils read this equation and explain why it is correct. Then ask someone to answer the question.

4 Next ask pupils to read this equation and decide what the missing number is. Then ask someone to read the explanation aloud, putting in the missing number.

5 Ask pupils to look at the picture and see if there are 18 tablets divided into 2 groups of 9. Have someone point out Jim's tablets, then Bill's.

6 Note that help is given for the first three problems of this set. Be sure children understand how to write the equations and how to solve them before doing the work on page 138.

D Sixteen children are dividing into 4 equal teams to play a game. How many children will there be on each team?

E Ann's mother gave 6 paper dolls to Ann and Mary. She gave each girl the same number of paper dolls. How many did she give to each girl?

F Ann cut out the same number of dresses for each of 5 paper dolls. She cut out 10 dresses in all. How many dresses did she cut out for each of the paper dolls?

G Bob paid 4¢ apiece for 2 pencils. How much in all did the 2 pencils cost him?

H Four girls had a picnic. They made 12 sandwiches. If they shared them equally, how many sandwiches did each girl get?

I Betty is putting 14 small dolls in 2 big doll beds. She will put the same number of dolls in each bed. How many will she put in each bed?

J Eight boys have a bag of 16 peanut butter cookies. If they share the cookies equally, how many cookies will each boy get?

K Mother made 2 cakes for a party. She cut each cake into 8 pieces. How many pieces of cake were there?

L Some cupcakes that Ann wants cost 7¢ apiece. She has 14¢ to spend. How many cupcakes can she buy?

M Mary is sharing 10 pennies equally with her sister. How many pennies should each girl get?

N Five girls are sharing 15 drawing pencils equally. How many should each girl get?

Now you should be able to find how large the equal groups are when you know the number of things in all and the number of equal groups.

Keeping skillful

A	15÷5=□	F	12÷□=2	K	14÷2=□	P	10÷5=□
B	8÷2=□	G	16÷□=4	L	9÷□=3	Q	16÷8=□
C	12÷4=□	H	14÷□=7	M	18÷□=6	R	15÷□=3
D	10÷2=□	I	6÷□=3	N	12÷3=□	S	18÷□=2
E	18÷3=□	J	18÷□=9	O	8÷□=4	T	12÷□=6

138

138

1 For each problem tell pupils to write th equation, write what they need to do to solv it, and then rewrite the equation, filling i the missing number. For example, for Prob lem E they should write: 6÷□=2; divid 6 by 2; 6÷3=2. Let the pupils work ind pendently without preliminary discussion o the problems.

2 Discuss the problems that were not well unde stood.

3 Handle this "Keeping skillful" exercise as separate activity. Tell pupils that when th screen comes before the equals sign they a to write what they must do to find the answ and then write the complete equation. For they should write "divide 12 by 2" an "12÷6=2." For the other equations, they ma write answers only.

139-141 Moving forward

Expanded Notes for this lesson are on pages 274-277.

Objectives

The child learns that 10 groups of 10 can be thought of as one group of 100. He learns how place value is used to indicate hundreds.

Vocabulary

New words page 140 hundred

Comments

This lesson extends the child's knowledge of the number system through three places. Work on the reading and writing of numbers is important because the basic principle of place value is being developed here. Later work in addition and subtraction involving carrying and borrowing will be much easier for the child if he has a sound knowledge of number system principles.

The lesson shows how objects may be organized in groups of hundreds, in groups of tens, and in ones for easy counting. The children learn how numerals representing these groups are placed in positions th indicate the quantity they stand for and that the sy bols 1 to 9 can be used to indicate hundreds as w as tens and ones.

Answers

Page 139:

The letter for the picture is given first, then the let for the tally box that belongs with the picture, then t letter for the correct three-figure number at the bott of the page.

A [C,B] B [I,G] C [J,H] D [A,J] E [D,F] F [G,

Page 141:

(block 1)

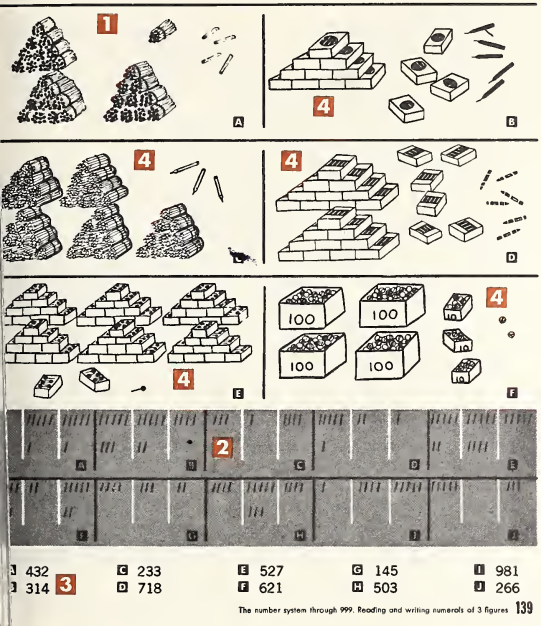
A	[A,J]	D	[G,P]	G	[B,M]	J	[E,J]	M	[F,N
B	[I,O]	E	[C,N]	H	[F,Q]	K	[B,Q]	N	[C,I
C	[D,K]	F	[E,L]	I	[H,R]	L	[I,K]	O	[A,J

(block 2)

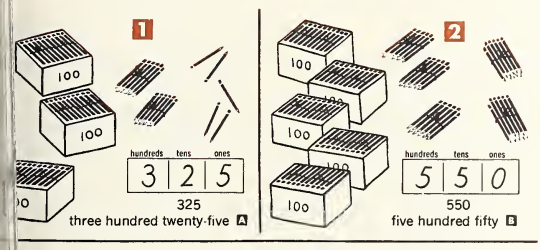
A	501	C	930	E	102	G	307	I	7
B	264	D	693	F	827	H	412		

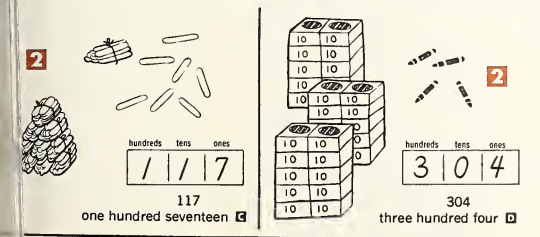
Moving forward

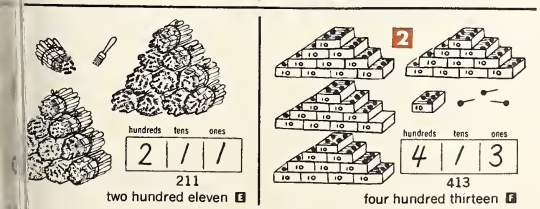
In this lesson you will learn how to read and write numerals with three figures in them.



The number system through 999. Reading and writing numerals of 3 figures 139







139

1 Suggest that the pupils look at Picture A. Explain to them that there are ten bundles of ten, or 100 sticks, in each pile. Ask how many piles of 100 sticks there are. Draw a tally box for a three-figure number on the board. (See Tally Box A.) Let a pupil tell how many tally marks should be put in the left section [one for each group of 100 sticks], how many in the middle section [one for each bundle of ten], and in the right section [one for each single stick] to represent the sticks in Picture A. If you wish, call on a pupil to put the proper marks in a tally box on the board. Write the correct numeral below the tally box for hundreds, tens, and ones.

2 Have pupils find the tally box among A to J that matches the tally box on the board [C].

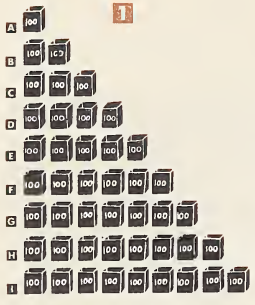
3 Let a pupil find the corresponding three-figure number in this section lettered A to J [B]. Have him read the number.

4 Use the same procedure for this picture.

140

1 Explain that on this page pupils will learn to write and read numbers that mean hundreds. Let each child draw a tally box on his paper. Make sure each tally box has three sections. Now direct attention to Picture A. Let a child find how many hundreds are in the picture and let him say how many tally marks should be made in the section for hundreds in the tally box. Let him tell how many tens and how many ones are in the picture. The other children should mark their tally boxes to correspond. Then ask the children to write the proper figures for the tally marks under each section of the tally box. Let a pupil read his number. Ask whether it is the same as the number in the picture. Call attention to the way the number is written in words.

2 Use similar procedure for this picture.



3

A one hundred ten
B nine hundred sixty
C four hundred twenty
D seven hundred seventy
E three hundred fifty
F five hundred thirty
G two hundred forty
H six hundred eighty
I eight hundred ninety
J five hundred ten
K two hundred eighty
L nine hundred twenty
M six hundred fifty
N three hundred thirty
O one hundred forty

2

4

Write

A five hundred one
B two hundred sixty-four
C nine hundred thirty
D six hundred ninety-three
E one hundred two
F eight hundred twenty-seven
G three hundred seven
H four hundred twelve
I seven hundred eighty-six

5

Read

A	410	E	380	I	614
B	762	F	526	J	384
C	809	G	901	K	790
D	273	H	150	L	537

Now you should be able to read and write numerals with three figures in them.

141

141

1 Note that the boxes are arranged so that line A shows 100, line B 200, and so on to line I, which shows 900. Let a pupil count by hundreds by saying the number of hundreds in each line of boxes from A to I.

2 Let a pupil count by tens by saying the number of tens in each line of boxes.

3 Ask a pupil to read the first number in these exercises. Then ask him to look at the two sets of boxes and find the row for the hundreds and the row for the tens that will give him this number [A, J]. Tell him to say the letters that stand for the correct rows. Let pupils take turns doing this for the rest of Exercises A to O.

4 Ask all the pupils to write in figures the numbers in these exercises. Let them read the numbers aloud, telling which figures stand for hundreds, tens, and ones.

5 Have the children take turns reading the numbers from A to L aloud.

142-143 Moving forward

Exponded Notes for this lesson are on pages 277-278.

Objectives

The child becomes acquainted with four-figure numbers. He learns that 10 groups of 100 can be thought of as 1000. He learns the place relationship of thousands to hundreds, tens, and ones. He learns how to read and write numbers with four figures.

Vocabulary

New words page 142 thousand; page 143 place*

Comments

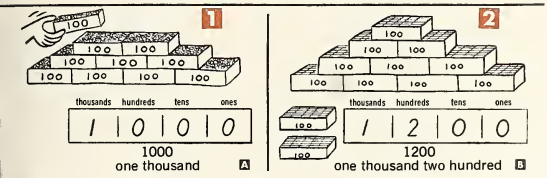
Up to this point work in the number system has been confined to three-figure numbers. In this lesson the concepts and skills the children have acquired are extended to include numbers in the thousands. The children use pictures to visualize thousands, hundreds, tens, and ones, and they learn where to place the numeral that stands for thousands. Note that the comma is not used in four-figure numerals in this book. The comma in numerals is not introduced until Grade 4, where it is used with five-figure numerals.

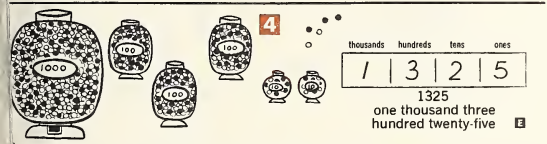
To help children understand the number system concepts taught in this lesson, you may supplement the pictures by using such materials as boxes of different sizes, bundles (paste sticks, etc.), and individual objects. Label the largest boxes 1000 and the smaller boxes 100. You may use still smaller boxes (labeled 10) or bundles for groups of 10. Arrange various collections to illustrate numerals of four figures and have the children respond orally and in writing.

By the time the children have finished work on this lesson they should begin to understand that in reading a number they begin at the left and give the value for every figure except the zeros.

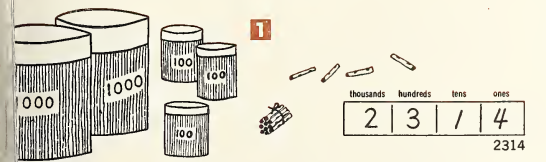
Moving forward

In this lesson you will learn to read and write numerals with four figures in them.





Development of the number system. Reading and writing numerals with 4 figures



2

- 4 is in ones' place.
- 1 is in tens' place.
- 3 is in hundreds' place.
- 2 is in thousands' place.

3

In 3064, ▢ is in hundreds' place.
In 1827, ▢ is in ones' place.
In 9365, ▢ is in thousands' place.
In 7918, ▢ is in tens' place.
In 642, ▢ is in tens' place.
In 1497, ▢ is in thousands' place.
In 2044, ▢ is in hundreds' place.
In 3428, ▢ is in ones' place.
In 821, ▢ is in tens' place.
In 9360, ▢ is in thousands' place.
In 6345, ▢ is in hundreds' place.

4

Read

A	1723	G	7655	M	8304
B	6485	H	4036	N	3784
C	9401	I	3759	O	7021
D	4839	J	8812	P	3002
E	5573	K	6340	Q	9090
F	2480	L	2947	R	7800

5

Write

- A six hundred ten
- B three thousand one hundred forty-two
- C seven thousand fifty
- D one hundred sixty-eight
- E eight thousand nine
- F five thousand nine hundred eighty-five
- G four hundred three
- H two thousand nine
- I nine thousand two hundred thirty-one
- J six thousand eight hundred
- K one thousand three hundred sixty
- L four thousand four hundred fifty-five
- M nine thousand two

6

Now you should be able to read and write numerals that have four figures in them.

142

1. Tell the children that the completed pile represents 10 hundreds, or 1000. Call attention to the new place (thousands) in the tally box. By now the children should have no trouble in understanding that a new place at the left is used to represent the number of thousands. Be sure the children recognize the fourth place to the left as thousands' place.
2. Get pupils to observe that this picture shows a pile of 1000, two boxes of 100, no tens, and no ones. Direct attention to the tally box. Let a pupil explain why the two zeros are written.
3. Have a pupil tell how many groups of 1000 he sees in this picture, how many groups of hundreds and tens, and how many single objects. Ask what the 3 in the left section of the tally box represents; then what the two 1's and the 6 represent.
4. Adapt Note 3 to this picture. Let a pupil read the four-figure number.

143

1. Direct attention to this picture and ask a pupil to tell the number of thousands, hundreds, tens, and ones that are shown. Have a pupil read the four-figure number that represents the picture.
2. Have pupils read these four statements and relate each one to the appropriate place in the tally box in the picture above.
3. Let the pupils take turns reading statements aloud, saying the missing figure in each statement. If a pupil has difficulty, let him draw a four-figure tally box, with each space labeled, and write in the number. This will help him see which numeral is in which place.
4. The pupils may take turns reading these numbers aloud.
5. Have the children write these with numerals.
6. Let a pupil read aloud the statement at the end of the lesson.

144-147 Moving forward

Expanded Notes for this lesson are on pages 278-281.

Objectives

The child uses the number system in learning to regroup ones into tens, tens into hundreds, and hundreds into thousands. This will help him understand how to carry in addition later on. He also uses the number system in learning to regroup thousands into hundreds, hundreds into tens, and tens into ones as a basis for understanding borrowing in subtraction.

Vocabulary

New words page 144 different

Comments

The principles of regrouping within the number system are of great importance because of their application to carrying in addition and borrowing in subtraction. Previous work has given the child experience in regrouping ones into tens and tens into ones. Now he learns how to handle situations where there are more than 9 hundreds, more than 9 tens, and more than 9 ones. He also learns how to change thousands to hundreds, hundreds to tens, and tens to ones.

Work with objects becomes more difficult as numbers become larger. However, it will help the child to understand the principles involved if you provide boxes labeled 1000, 100, and 10, and also single objects. By the time children finish this lesson, they should understand how the components of a number can be rearranged and restated without changing its value.

Answers

Page 145:

(block 1)

A 1 thousand 12 hundreds 2 tens 3 ones=2223

B 4 hundreds 9 tens 16 ones=506

C 2 thousands 10 hundreds 4 tens 1 one=3041

(block 2)

A 8 hundreds 4 tens 3 ones. The number is 843.

B 2 thousands 5 hundreds 7 tens 4 ones. The number is 2574.

C	4886	G	3335	K	8024	O	527	S	4504	W	8009
D	4742	H	940	L	2625	P	8240	T	9654	X	1156
E	991	I	9089	M	514	Q	3152	U	5421	Y	1085
F	6211	J	1168	N	2643	R	728	V	1102	Z	8969

Page 147:

(block 1)

A 2143=2 thousands 1 hundred 4 tens 3 ones

B 2143=2 thousands 1 hundred 3 tens 13 ones

C 2143=2 thousands 0 hundreds 14 tens 3 ones

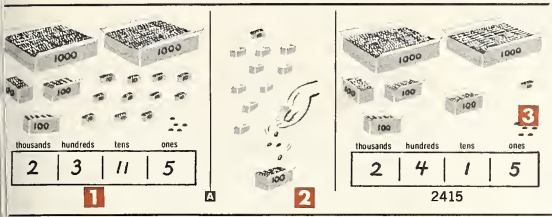
D 2143=2 thousands 0 hundreds 13 tens 13 ones

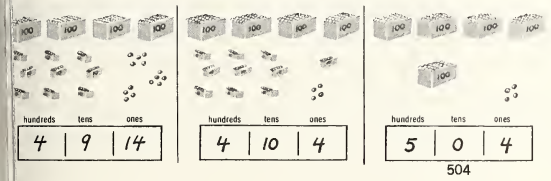
(block 2)

A	12 hundreds	N	10 tens
B	10 tens	O	18 tens
C	8 tens	P	14 hundreds, 12 one
D	3 thousands	Q	16 ones
E	12 ones	R	12 hundreds, 18 one
F	17 tens	S	10 tens
G	10 tens	T	11 hundreds, 15 one
H	15 hundreds	U	12 tens
I	11 ones	V	18 hundreds, 12 one
J	16 tens	W	18 hundreds, 12 one
K	10 hundreds	X	10 ones
L	12 hundreds	Y	4 hundreds, 13 ones
M	16 tens	Z	14 hundreds, 16 one

Moving forward

This lesson will show you some different ways in which you can think about numbers.





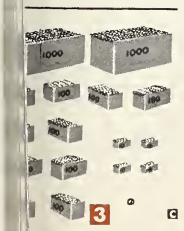
4 Regrouping of 3- and 4-figure numbers as preparation for carrying and borrowing

A ■ thousand ■ hundreds ■ tens ■ ones = ■
B ■ hundreds ■ tens ■ ones = ■
C ■ thousands ■ hundreds ■ tens ■ one = ■

A 7 hundreds 14 tens 3 ones can be 8 hundreds ■ tens ■ ones. The number is ■. 4

B 2 thousands 5 hundreds 6 tens 14 ones can be 2 thousands ■ hundreds 7 tens ■ ones. The number is ■.

C 3 thousands 15 hundreds 38 tens 6 ones = ■
D 4 thousands 6 hundreds 14 tens 2 ones = ■
E 8 hundreds 17 tens 21 ones = ■
F 5 thousands 12 hundreds 0 tens 11 ones = ■
G 3 thousands 2 hundreds 13 tens 5 ones = ■
H 6 hundreds 34 tens 0 ones = ■
I 6 thousands 29 hundreds 17 tens 19 ones = ■
J 8 hundreds 35 tens 18 ones = ■
K 7 thousands 9 hundreds 11 tens 14 ones = ■
L 1 thousand 14 hundreds 22 tens 5 ones = ■
M 3 hundreds 19 tens 24 ones = ■
N 2 thousands 5 hundreds 12 tens 23 ones = ■
O 2 hundreds 31 tens 17 ones = ■
P 8 thousands 2 hundreds 1 ten 30 ones = ■
Q 3 thousands 0 hundreds 15 tens 2 ones = ■
R 5 hundreds 19 tens 38 ones = ■
S 1 thousand 35 hundreds 0 tens 4 ones = ■
T 9 thousands 5 hundreds 12 tens 34 ones = ■
U 3 thousands 21 hundreds 29 tens 31 ones = ■
V 6 hundreds 47 tens 32 ones = ■
W 7 thousands 7 hundreds 29 tens 19 ones = ■
X 9 hundreds 25 tens 6 ones = ■
Y 9 hundreds 16 tens 25 ones = ■
Z 5 thousands 38 hundreds 13 tens 39 ones = ■



144

1 Let the class examine the first scene of this movie and the number shown in the tally box. Get them to tell how many thousands, hundreds, tens, and ones are shown. Let them discover that there are enough tens to make another hundred.

2 In this scene the children should observe that 9 boxes are empty and the hand is emptying the tenth box of 10 into the box of 100, thus making a new hundred. Of the 11 boxes of 10 we had at first, one box of 10 is left.

3 Get the children to note that the new box of 100 has been placed with the 3 original boxes of 100. Ask a pupil to tell how many thousands, hundreds, tens, and ones are shown now. Have the number below the tally box read aloud. Compare this scene with Scene 1. Get the children to observe that the number of objects is the same in both scenes but that their arrangement differs.

4 Adapt Notes 1, 2, and 3 to Movies B and C.

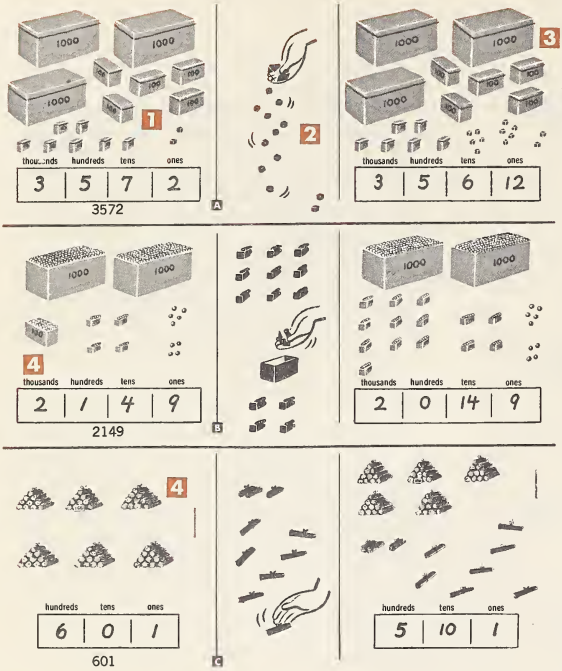
145

1 Tell the pupils to represent the grouping of the objects in this picture by writing numerals in a four-figure tally box. Let them draw a second tally box. Ask them to tell how the objects could be regrouped, and have them write numerals in the second box to express the regrouping. Let a pupil read and complete Statement A at the top of the page.

2 Proceed with this picture similarly, except that in this case the children should draw three four-figure tally boxes. In the first box they should write the numerals that represent the picture; in the second, the regrouping of ones and tens; and in the third, the regrouping of tens and hundreds. Have someone complete Statement B at the top of the page.

3 Treat this picture in a similar manner and have Statement C at the top of the page completed.

4 Have the children give answers directly for these exercises. Permit them to use tally boxes if they have difficulty.



146

146

1 Direct attention to the first scene of this movie and to the number representing the complete collection of tiny blocks. Tell the children that later on in their work they will need to know how to regroup numbers and that this movie shows one way the number 3572 can be regrouped. Have a pupil tell how many thousands, hundreds, tens, and ones are shown.

2 Be sure the children understand here that one box of 10 has been opened. The 10 little blocks it contains are being put with the 2 original blocks.

3 Get the children to determine the number of thousands, hundreds, tens, and ones shown in this scene and written in the tally box. Be sure they understand that the number of objects is the same in Scene 3 as in Scene 1—only the grouping differs.

4 Proceed in the same way with this movie. Note that this time a hundred is being regrouped into tens.

A 2143 = ▢ thousands ▢ hundred ▢ tens ▢ ones
B 2143 = ▢ thousands ▢ hundred ▢ tens ▢ ones
C 2143 = ▢ thousands ▢ hundreds ▢ tens ▢ ones
D 2143 = ▢ thousands ▢ hundreds ▢ tens ▢ ones

A 8245 = 7 thousands ▢ hundreds 4 tens 5 ones
B 607 = 5 hundreds ▢ tens 7 ones
C 1392 = 1 thousand 3 hundreds ▢ tens 12 ones
D 4781 = ▢ thousands 17 hundreds 8 tens 1 one
E 1042 = 1 thousand 0 hundreds 3 tens ▢ ones
F 973 = 8 hundreds ▢ tens 3 ones
G 5204 = 5 thousands 1 hundred ▢ tens 4 ones
H 2589 = 1 thousand ▢ hundreds 8 tens 9 ones
I 7621 = 7 thousands 6 hundreds 1 ten ▢ ones
J 264 = 1 hundred ▢ tens 4 ones
K 3017 = 2 thousands ▢ hundreds 1 ten 7 ones
L 9249 = 8 thousands ▢ hundreds 3 tens 19 ones
M 8760 = 8 thousands 6 hundreds ▢ tens 0 ones
N 200 = 1 hundred ▢ tens 0 ones
O 3487 = 3 thousands 3 hundreds ▢ tens 7 ones
P 5472 = 4 thousands ▢ hundreds 6 tens ▢ ones
Q 486 = 4 hundreds 7 tens ▢ ones
R 6238 = 5 thousands ▢ hundreds 2 tens ▢ ones
S 1000 = 9 hundreds ▢ tens 0 ones
T 8145 = 7 thousands ▢ hundreds 3 tens ▢ ones
U 524 = 4 hundreds ▢ tens 4 ones
V 7842 = 6 thousands ▢ hundreds 3 tens ▢ ones
W 4862 = 3 thousands ▢ hundreds 5 tens ▢ ones
X 930 = 9 hundreds 2 tens ▢ ones
Y 2413 = 2 thousands ▢ hundreds 0 tens ▢ ones
Z 3416 = 2 thousands ▢ hundreds 0 tens ▢ ones

4

5 Now you should understand more about numerals and what they mean.

147

147

1 Have the children look at Picture A and tell the number of thousands, hundreds, tens, and ones there are. Let them write the number in a tally box. Ask them to read and complete Statement A.

2 Call attention to Picture B. Point out that the number of sticks is the same as in Picture A, but that they have been arranged differently. Have the pupils write the number that shows this new arrangement in a tally box. Let a pupil read and complete Statement B.

3 Treat Pictures C and D and Statements C and D similarly.

4 Have the pupils take turns in answering these exercises directly. If some pupils have difficulty, let them write in a tally box the number as it is given. Then, in another tally box, they may write the number regrouped according to the statement in the book.

5 Ask a pupil to read the final statement.

148-151 Moving forward

Expanded Notes for this lesson are on pages 281-283.

Objectives

The child learns the coin equivalents of one dollar. He learns what combinations of coins make a dollar and how to write amounts of money with the point and dollar sign.

Vocabulary

New words page 148 amounts

Comments

In this lesson the children learn how to count and write amounts of money. On page 148 coins of different denominations are shown to demonstrate how many coins of any one denomination are equal to a dollar and to give pupils practice in counting different coins that equal one dollar. On page 149 the children learn to count amounts of money beyond a dollar. On page 150 they learn to count amounts of money and write the total with the point and dollar sign. At this stage the "point" is not called a "decimal point" because the children do not learn about decimal fractions until later grades. Page 151 gives the pupils opportunity to practice reading and writing amounts of money and to think of amounts of money as combinations of various coins.

Though our money system is decimal in nature, the use of 5-cent and 25-cent coins makes it necessary that the child learn to count by 5's and 25's. In doing this work, children should become aware of the importance of 5 and 25 in counting money.

The stylized type of coin is used to enable the child to distinguish among the coins easily. Real coins are difficult to identify in pictures, and such difficulty results in fumbling work by pupils. Of course, real coins should be available to lend interest and understanding to the lesson. The law does not permit the reproduction of paper money in pictures.

Answers

Page 149:

1 dollar, 50, 60, 70, 71;
1 dollar and 71 cents
1 dollar, 25, 50, 60, 70 (or 55, 60, 65, 70);
1 dollar and 70 cents
2 dollars, 3 dollars, 5, 10, 15;
3 dollars and 15 cents
M 5 dollars, 10, 20, 30, 35, 37;
5 dollars and 37 cents
N 50, 1 dollar, 50, 2 dollars
O 50, 75, 1 dollar, 25, 35;
1 dollar and 35 cents
P 5 dollars, 10, 15, 16, 17, 18, 19;
5 dollars and 19 cents
Q 50, 1 dollar, 25, 30, 31, 32;
1 dollar and 32 cents
R 5 dollars, 7 dollars, 25, 50, 51;
7 dollars and 51 cents
S 50, 75, 85, 95, 1 dollar 5, 1 dollar 15;
1 dollar and 15 cents

Page 150:

G $5.81	J $10.50	M 36¢ or $.36
H 64¢ or $.64	K $6 or $6.00	N $1.45
I $3.07	L 4¢ or $.04	O $2 or $2.00

Page 151:

(block 2)

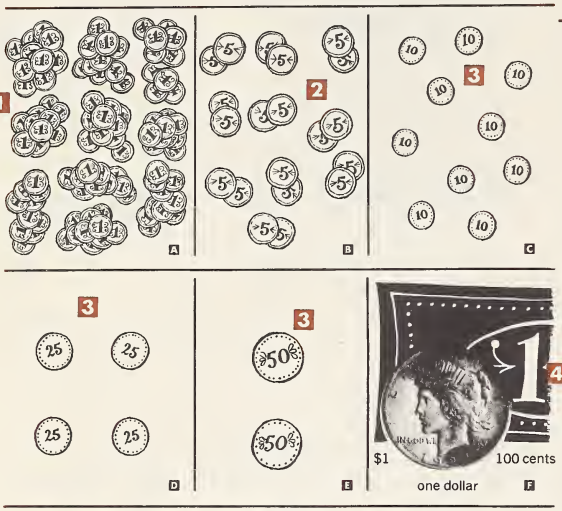
A $4.30	H $7 or $7.00
B 55¢ or $.55	I 92¢ or $.92
C $10 or $10.00	J 20¢ or $.20
D $1.11	K $20 or $20.00
E $13.68	L $20.01
F $4.03	M $20.10
G 7¢ or $.07	

(block 4)

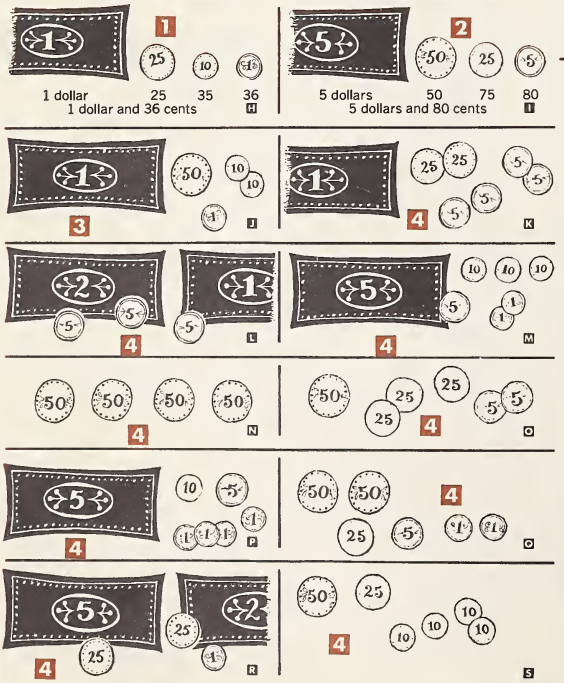
A 5 pennies	F 2 quarters	K 10 nickels
B 10 pennies	G 4 nickels	L 3 dimes
C 5 nickels	H 10 nickels	M 2 nickels
D 5 dimes	I 25 pennies	N 3 quarters
E 3 nickels	J 25 pennies	

Moving forward

Now you will learn about the dollar. You will also learn more about counting and writing amounts of money.



148 Equivalent money values for the dollar; counting and writing amounts of money beyond $1



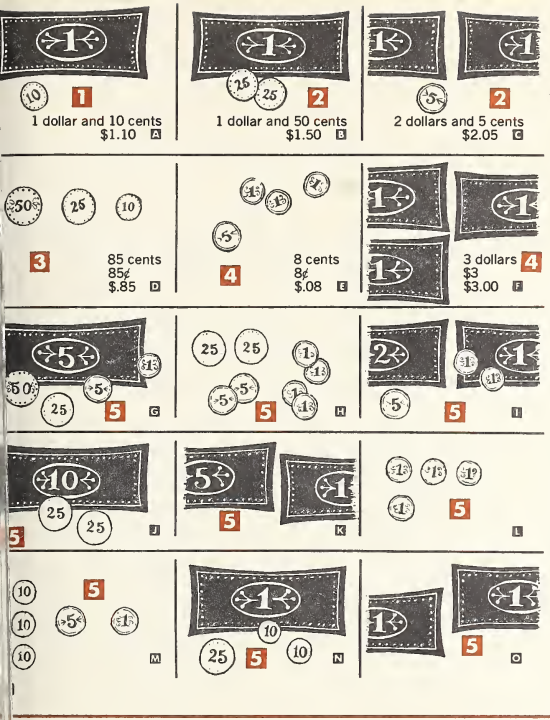
149

148

1. Point out that the pennies are grouped in tens and that there are enough pennies to equal one dollar. Point out and identify the silver dollar and the paper dollar in Picture F. Have a pupil count the pennies by tens.
2. The nickels are arranged so that the value can be counted by tens. Ask a child to count the value by tens. Ask another child how many nickels are equal to one dollar.
3. Let the pupils discover that ten dimes, four quarters, and two half dollars are each equivalent to one dollar. For the dimes let them count by tens, for the quarters by twenty-fives, and for the half dollars by fifties.
4. If possible, have real money available to show the children what a silver dollar and a dollar bill look like. Direct attention to the ways in which the value of a dollar may be written.
5. Point out the denominations of these bills and the way in which the amounts they represent are written.

149

1. Ask a pupil to name the bill and coins. Have him find the total amount pictured by counting the money from left to right. Let him read the text. Point out the way the total amount is read. If possible, have on hand the pieces of money shown in Picture H and let children count them.
2. Let a pupil name these pieces of money. Ask another pupil to count the money, going from left to right. Let another pupil read the statement of the total amount.
3. Have the money in this picture counted. Ask the children to write on their papers what they would say in counting the money. Lead them to write, "1 dollar, 50, 60, 70, 71." Have them say the total as "1 dollar and 71 cents."
4. Use Note 3 with this picture.



Read 1

A	$7.46	N	$.76
B	$.59	O	$76
C	$.70	P	$9.07
D	31¢	Q	$25.95
E	$12.00	R	$18.30
F	$.05	S	$.03
G	$20.50	T	$3.00
H	$.17	U	$30
I	$4.00	V	$8.93
J	$40.00	W	$1.08
K	$.40	X	$10.80
L	$6.08	Y	$14.75
M	$33	Z	$22.67

Write with numerals and signs. 2

A	four dollars and thirty cents
B	fifty-five cents
C	ten dollars
D	one dollar and eleven cents
E	thirteen dollars and sixty-eight cents
F	four dollars and three cents
G	seven cents
H	seven dollars
I	ninety-two cents
J	twenty cents
K	twenty dollars
L	twenty dollars and one cent
M	twenty dollars and ten cents

A	1 dollar = ▪ dimes	A	1 dime = 1 nickel ▪ pennies
B	1 dollar = ▪ quarters	B	1 quarter = 3 nickels ▪ pennies
C	1 half dollar = ▪ dimes	C	1 half dollar = 1 quarter ▪ nickels
D	1 quarter = ▪ nickels	D	1 dollar = 2 quarters ▪ dimes
E	1 dollar = ▪ cents	E	1 quarter = 1 dime ▪ nickels
F	1 dime = ▪ nickels	F	1 dollar = 1 half dollar ▪ quarters
G	1 quarter = ▪ cents	G	1 quarter = ▪ nickels 5 pennies
H	1 dollar = ▪ nickels	H	1 dollar = 5 dimes ▪ nickels
I	1 nickel = ▪ cents	I	1 dollar = 3 quarters ▪ pennies
J	1 half dollar = ▪ quarters	J	1 half dollar = 5 nickels ▪ pennies
K	1 dollar = ▪ half dollars	K	1 dollar = 2 quarters ▪ nickels
L	1 dime = ▪ cents	L	1 half dollar = ▪ dimes 4 nickels
M	1 half dollar = ▪ nickels	M	1 quarter = ▪ nickels 15 pennies
N	1 half dollar = ▪ cents	N	1 dollar = ▪ quarters 5 nickels

3 4

5 Now you should be able to count and write dollars and cents.

150

1 After this money has been counted, call attention to the text and point out how the amount can be written with symbols. Write the dollar sign on the board and let the children practice writing it. Write $1.10 on the board. Explain that the point separates the number of dollars from the number of cents. Let the class write the amount on their papers.

2 Handle this picture in the same way.

3 Let a child count the money in Picture D. Ask the class to write "85 cents" on their papers. Point out the two other ways of writing this amount, as shown in the book. Have the children write the three ways on their papers.

4 Proceed in the same way with this picture.

5 Ask a child to count the money in this picture. Let the pupils write the amount in more than one way if they can.

151

1 Let the children take turns reading aloud these amounts of money.

2 Ask a pupil to read Exercise A aloud. Let him write it on the board, using symbols. Ask all the children to write it on their papers. Then direct them to write with numerals and signs the other statements opposite the labeling letters.

3 Let the children take turns reading and completing these exercises. If possible, provide real coins for the children to use in case any of them have difficulty.

4 The children may copy the letters A to N in a column on their papers and write the missing numbers after them. The exercises may also be used for oral response.

5 Ask a child to read the statement at the end of the lesson.

152 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child takes written tests on writing three-figure and four-figure numerals, on writing dollars and cents, and on money equivalents including the dollar.

Vocabulary

There are no new words in this lesson.

Comments

Since these are not speed tests, the pupils should be given as much time as they need to complete them. Pages 139-141 (number system) and pages 52-55, 148-151 (money) should be used for review if it is needed.

Ask the pupils to copy the labeling letters for the exercises in each test and write the answers after the letters on their papers.

In the "Keeping skillful" exercises, the children may either write the labeling letter and the missing number, or they may write the whole equation, filling in the missing number.

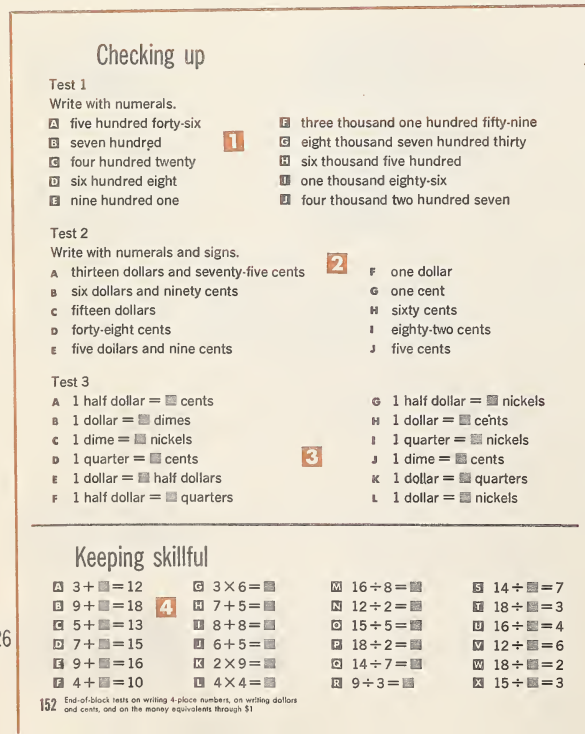
Answers

Test 1

A 546	C 420	E 901	G 8730	I 1086
B 700	D 608	F 3159	H 6500	J 4207

Test 2

A $13.75	E $5.09	H 60¢ or $.60
B $6.90	F $1 or $1.00	I 82¢ or $.82
C $15 or $15.00	G 1¢ or $.01	J 5¢ or $.05
D 48¢ or $.48		



Checking up

Test 1

Write with numerals.

A five hundred forty-six
B seven hundred
C four hundred twenty
D six hundred eight
E nine hundred one
F three thousand one hundred fifty-nine
G eight thousand seven hundred thirty
H six thousand five hundred
I one thousand eighty-six
J four thousand two hundred seven

1

Test 2

Write with numerals and signs.

A thirteen dollars and seventy-five cents
B six dollars and ninety cents
C fifteen dollars
D forty-eight cents
E five dollars and nine cents
F one dollar
G one cent
H sixty cents
I eighty-two cents
J five cents

2

Test 3

A 1 half dollar = ▢ cents
B 1 dollar = ▢ dimes
C 1 dime = ▢ nickels
D 1 quarter = ▢ cents
E 1 dollar = ▢ half dollars
F 1 half dollar = ▢ quarters
G 1 half dollar = ▢ nickels
H 1 dollar = ▢ cents
I 1 quarter = ▢ nickels
J 1 dime = ▢ cents
K 1 dollar = ▢ quarters
L 1 dollar = ▢ nickels

3

Keeping skillful

A 3+▢=12
B 9+▢=18
C 5+▢=13
D 7+▢=15
E 9+▢=16
F 4+▢=10
G 3×6=▢
H 7+5=▢
I 8+8=▢
J 6+5=▢
K 2×9=▢
L 4×4=▢
M 16÷8=▢
N 12÷2=▢
O 15÷5=▢
P 18÷2=▢
Q 14÷7=▢
R 9÷3=▢
S 14÷▢=7
T 18÷▢=3
U 16÷▢=4
V 12÷▢=6
W 18÷▢=2
X 15÷▢=3

4

152 End-of-block tests on writing 4-place numbers, on writing dollars and cents, and on the money equivalents through $1

152

1 Test 1 tests the children's ability to write three-figure and four-figure numerals.

2 Test 2 tests the children's ability to write amounts of money with numerals and signs. You may instruct the children to use the point in writing each amount.

3 Test 3 tests the children's understanding of money equivalents up to one dollar.

4 Let the class write and complete the equations in "Keeping skillful."

153-155 Learning how

Exponded Notes for this lesson are on poges 283-285.

Objectives

The child learns to add a one-figure number to a two-figure number.

Vocabulary

New words page 153 acorns; page 154 playground*; page 155 try*

You will want to use the word *sum* orally with this lesson, since it will appear as a reading word in the next lesson, page 156.

Comments

Whenever a column of more than two numbers is to be added, there is always a number to be remembered. To that "unseen" but remembered number another number must be added. For example, suppose 3, 6, 7, and are to be added. Here 3+6=9, but the 9 is not written and must be remembered. Then 7 is added to the 9, and the result 16 must be remembered. Each of these first two additions involves knowing an addition basic fact. Finally, 8 is added to 16, but to find 16+8 requires something beyond the basic facts. It involves knowing the addition basic fact 6+8=14 and seeing that the sum will be in the next decade beyond 16. The sum will be in the twenties—24.

Traditionally, this process has been called "adding endings," and the example above involves "bridging" from the teens to the next decade. The process has been taught and the skill developed by reliance upon rules and drill methods.

The development in this book, however, emphasizes understanding. The previous work on the number system has provided the foundation for this understanding. The pictures and text focus the children's attention on the main new idea—namely, that in some addition problems a new group of ten is formed. Note the use of the ring in the pictures to help identify a group of without counting. Also note the arrangement of the objects in the final picture for each problem. This arrangement makes it easy to "see" the tens immediately. This is the first lesson on real computation and the first use of the "four-step" teaching method. This method will be used for all lessons on computation. The SEE step (page 153) illustrates and explains how to proceed with the addition of a one-figure number to a two-figure number. The pictures and text in the THINK step (page 154) present a similar problem. To carry the children along farther—to help them think things through for themselves—questions are used in place of explanations. The TRY step (page 155) provides problems and exercises with answers against which children can check their solutions, but gives them no further help through explanations or illustrations. The DO step (also on page 155) provides problems and examples for practice, but neither help nor answers.

These four steps are based on a teaching method that many successful teachers use consistently, usually orally with work on the board, in presenting new material. Here the steps are systematically employed and are implemented by pictures, explanations, questions, examples, and problems. The SEE and THINK steps have been planned to be taught under the direct guidance of the teacher with the aid of the book. The TRY and DO steps are intended to be used independently by pupils. They also provide a means for taking care of individual differences in two ways. First, the teacher is free to work with those who need assistance in the TRY step at the time when they most need it. Second, the better students may try as many problems or examples of the TRY step as they need, then go immediately to the DO step.

Answers

Page 155:

(block 1)

A 36	E 17	I 18	M 60	Q 32	U 40
B 42	F 54	J 46	N 29	R 83	V 46
C 95	G 40	K 33	O 20	S 37	W 27
D 31	H 15	L 40	P 49	T 25	X 29

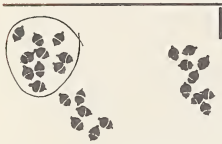
(block 2)

A 22	E 29	I 27	M 44	Q 34	U 50
B 25	F 74	J 98	N 50	R 19	V 23
C 36	G 23	K 97	O 98	S 37	
D 67	H 41	L 31	P 18	T 31	

Learning how

This lesson will show you how to add a number with one figure to a number with two figures.

see



1 Dick had 16 acorns. Jack gave him 9 more acorns. Then Dick had how many acorns?

A

$16+9=\square$ 2 You must find this number.

B Think of the 9 acorns as being put with the 16 acorns.

You will add 9 to 16.

3

4

C Now you have another group of 10 acorns and 5 acorns.

When you add 9 to 16, you have another ten and 5 ones.

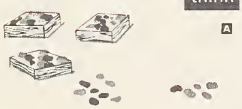
5

D There are 2 groups of 10 acorns and 5 acorns.

16+9=2 tens 5 ones 16+9=25

Dick had 25 acorns.

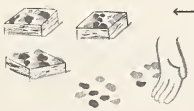
think



1

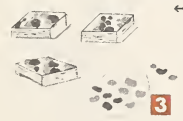
A Ann found 38 stones on the playground. Mary found 5 stones. How many stones did the two girls find?

$38+5=\square$ You must find this number.



B What must you think of doing with the 5 stones? 2

What do you add to 38?



3

C Have you made another group of 10 stones?

When you add 5 to 38, will you have another ten?

4

D There are ■ groups of 10 stones and ■ stones.

38+5=■ tens ■ ones

38+5=■

The girls found ■ stones in all.

153

1 Tell pupils to read the problem and look at the picture. Let them identify Dick's acorns and the acorns Jack gave him. Be sure pupils understand the use of the ring to identify a group of 10.

2 Draw attention to the equation and the statement. Get the children to relate the equation to Picture A.

3 Get the children to interpret the action shown in this picture.

4 Be sure the children see that when 9 acorns have been added to 16 acorns, another group of 10 has been made. Let them point out this group of 10 and the 5 extra acorns.

5 Note the new, more formal arrangements of the acorns. Relate the statements to the picture. Be sure the children understand that 2 tens and 5 ones may be written 25.

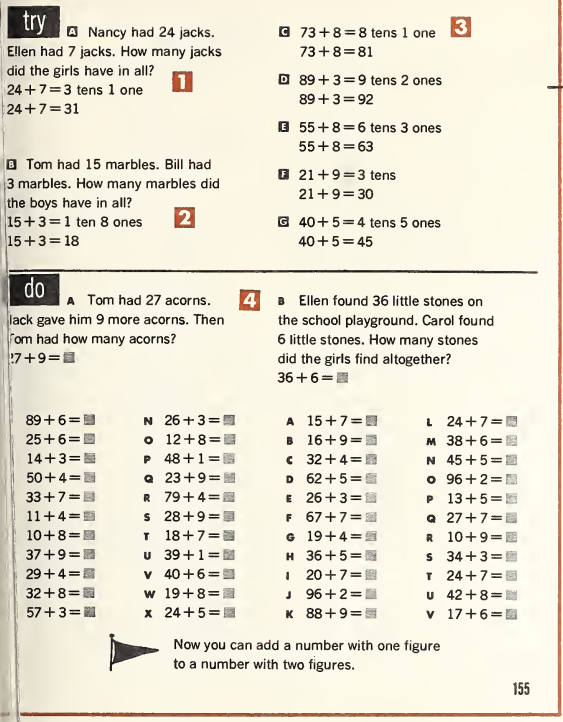
154

1 Explain to the pupils that in the THINK step they will have to supply the answers. Tell them to study each picture carefully to find the answers. Have them read the problem and the equation and identify the data with the objects shown in the picture.

2 Be sure the children answer this question in terms of the action shown in the picture, where 5 stones are being added to 38 stones.

3 Have a pupil explain where the new group of 10 came from.

4 Point out that this new group of 10 stones has been put into a box. Have the statements read aloud, with different pupils supplying the missing numbers.



try

A Nancy had 24 jacks. Ellen had 7 jacks. How many jacks did the girls have in all?
24+7=3 tens 1 one
24+7=31

B Tom had 15 marbles. Bill had 3 marbles. How many marbles did the boys have in all?
15+3=1 ten 8 ones
15+3=18

C 73+8=8 tens 1 one
73+8=81

D 89+3=9 tens 2 ones
89+3=92

E 55+8=6 tens 3 ones
55+8=63

F 21+9=3 tens
21+9=30

G 40+5=4 tens 5 ones
40+5=45

do

A Tom had 27 acorns. Jack gave him 9 more acorns. Then Tom had how many acorns?
27+9=

B Ellen found 36 little stones on the school playground. Carol found 6 little stones. How many stones did the girls find altogether?
36+6=

89+6= N 26+3= A 15+7= L 24+7=
25+6= O 12+8= B 16+9= M 38+6=
14+3= P 48+1= C 32+4= N 45+5=
50+4= Q 23+9= D 62+5= O 96+2=
33+7= R 79+4= E 26+3= P 13+5=
11+4= S 28+9= F 67+7= Q 27+7=
10+8= T 18+7= G 19+4= R 10+9=
37+9= U 39+1= H 36+5= S 34+3=
29+4= V 40+6= I 20+7= T 24+7=
32+8= W 19+8= J 96+2= U 42+8=
57+3= X 24+5= K 88+9= V 17+6=

Now you can add a number with one figure to a number with two figures.

155

155

1 Call on a pupil to read this problem aloud. Ask him if he thinks his answer will be in the next higher ten and why or why not. Ask him how many ones he thinks he will have in his answer. Ask what number 3 tens and 1 one is.

2 Handle this problem in the same way. Be sure the children see that in adding 3 to 15 they do not have one more ten. Point out that in adding a one-figure number to a two-figure number, their answer will be either in the same ten or in another ten and that the tens' number may be thought of first.

3 Use the same type of questions for Exercises C to G.

4 These problems and exercises (A to X and A to V) should be handled orally first. Then pupils may write the identifying letters with the answer after each letter.

56-159 Learning how

anded Notes for this lesson are on pages 285-287.

jectives

e child learns to add three or more one-figure num-'s.

:abulary

w words page 156 remember*, here*, sum

nments

understandings and skills developed in the preced- lesson are put to use in this lesson. In adding a umn of figures, children learn to look at the first numbers and to think the answer (which should ie to mind immediately because a basic fact is olved). They learn to keep this number in mind as look at the next number and decide whether these numbers, added together, will give them an answer ie same decade (ten) or in the next decade. Then determine how many ones there are. They learn o this quickly as they add a column of figures. The number they must keep in mind changes as they go down the column, as does the number that they must add to it, which they see on the paper. Although in this text it does not matter whether children add up or down a column, for purposes of consistent presentation of new material all adding is begun at the top.

Children should be able to compute mentally when adding three or more one-figure numbers. Therefore, they should be able to add when the example is given in equation form. For written assignments, however, they may rewrite the figures in column arrangement.

Note that in the illustrations the groups not under direct attention are dimmed off. In the computational form at the side, the numeral or numerals under discussion are always in black in the textbook.

The four-step teaching method is used in this lesson to present the new material. Note that in the DO step (pages 158-159) an extra set of examples (A to F) has been provided for those children who need more practice. In all succeeding lessons entitled "Learning how,"

there will be two sets of practice exercises in the DO step.

Answers

Learning how (pages 158-159):

(block 1)

A 15	D 26	G 18	J 18	M 25	P 22
B 15	E 17	H 24	K 20	N 24	Q 32
C 21	F 24	I 24	L 18	O 21	R 17

(block 2)

A 16	B 23	C 17	D 19	E 22	F 21

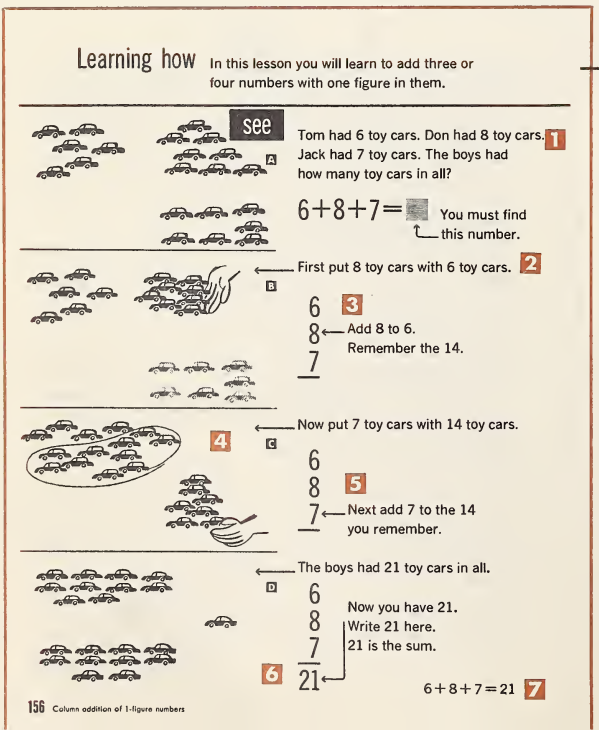
Keeping skillful:

(block 1)

A 18	D 26	G 20	J 24	M 30	P 25
B 21	E 29	H 20	K 16	N 22	Q 24
C 23	F 23	I 23	L 20	O 29	R 15

(block 2)

A 31	E 83	I 20	M 44	Q 64
B 21	F 99	J 59	N 89	R 94
C 90	G 42	K 74	O 55	S 21
D 42	H 18	L 18	P 21	T 33



156

1 Have pupils read the problem only. Ask whom each group of cars belongs. Then relo the equation to the picture and problem.

2 Let a pupil read the sentence introducing P ture B and note the action shown.

3 Direct pupils to examine the column of n merals and compare them with the equati above. Explain that the black numerals in t textbook stand for the objects being work with in the picture.

4 Have pupils look at this picture and the se tence with it. Ask: "What does the ring sh in the top group of cars? What is happening

5 Direct attention to the computation. A "What does the 7 stand for? Why do you a it to 14?" Have pupils explain why the answ will be in the twenties and not the teens.

6 Be sure the pupils observe the sum and co pare it with the cars shown in the picture

7 Have pupils compare this equation with t one at the top of the page.

think

A Carol had 5 little dolls. Betty had 3 dolls, Mary had 7 dolls, and Ellen had 9 dolls. The girls had how many dolls in all? 1

$5+3+7+9=\blacksquare$ 2

You must find this number.

B Which group of dolls do you put with the group of 5 dolls? 3

5
3 ← What number do you add to the 5? What number do you remember? 4
7
9

C How many dolls do you put with 8 dolls? 5

5
3 6
7 ← Now add ■ to 8. What number do you remember?
9

D How many dolls do you put with 15 dolls? 7

5
3
7
9 ← What do you add to 15?

8 Now turn the page.

157

E 1

5
3
7
9 2 What number do you write here?
■ ← What is the sum?

← The girls had ■ dolls in all.

$5+3+7+9=\blacksquare$

try

A Jack had 9 marbles, ck had 6 marbles, and Bill had marbles. The boys had how many arbles in all?
$+6+8=\blacksquare$ 4

9
6
8
23 5

B Dick took 7 sandwiches 3 a picnic, his father took 7, d his mother took 6. How many ndwiches in all did they take the picnic?
$-7+6=\blacksquare$ 4

7
7
6
20 5

C $5+4+8+6=\blacksquare$ 6

5
4
8
6
23

D $7+8+9=\blacksquare$ 6

7
8
9
24

do

A Mary had 5 toy chairs. bought 6 more, and her sister e her 4. Then Mary had how many chairs?
$6+4=\blacksquare$ 7

B Bill had 9 small boats. He bought 4 more, and his father gave him 2 for his birthday. Then Bill had how many small boats?
$9+4+2=\blacksquare$ 7

157

1 Tell pupils to read the problem. Get them to decide which group of dolls belongs to each of the four girls.

2 Direct attention to the equation and identify it with the data in the problem and picture.

3 Note that the groups of dimmed-off dolls are those not under immediate discussion.

4 Have the first question read and direct attention to the computation. Let a pupil answer the next two questions.

5 Get pupils to see that a group of 7 dolls is being put with the 8 dolls.

6 Direct attention to the 7 and the statement and question beside the arrow.

7 Ask what the ring means in this picture. Then have a pupil answer the question beside the arrow.

8 Have a pupil relate the question to the picture.

158

1 Have pupils look at the picture to see how many dolls the girls had in all.

2 Ask a pupil to complete adding the column mentally. Then call on pupils to read the questions and statements, filling in the missing numbers.

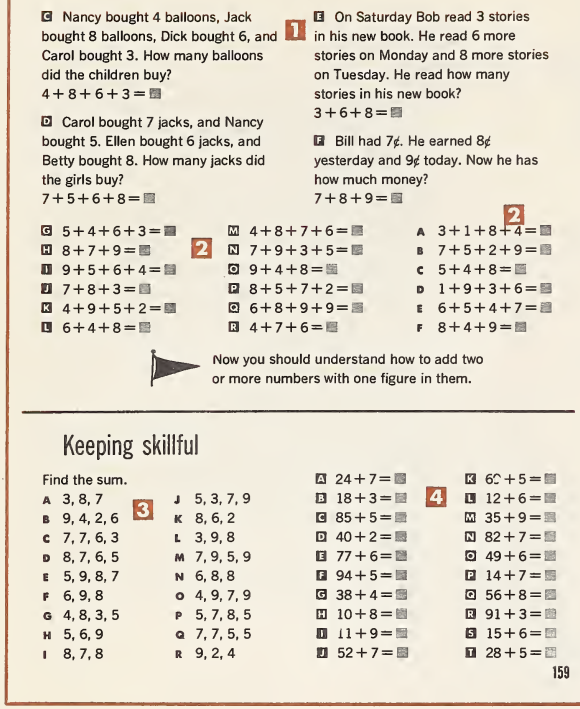
3 Tell pupils to read this problem to themselves.

4 Ask them to read this equation and find the answer, either by adding the numbers from left to right or by copying the numbers in computational form and then adding.

5 Tell pupils to compare answers with this one.

6 Tell them to read the equation and find the answer, either by adding from left to right or by copying the figures in computational form and then adding. Explain that they should compare their work with that in the book.

7 Have the children work this problem independently.



C Nancy bought 4 balloons, Jack bought 8 balloons, Dick bought 6, and Carol bought 3. How many balloons did the children buy?
4+8+6+3=

D Carol bought 7 jacks, and Nancy bought 5. Ellen bought 6 jacks, and Betty bought 8. How many jacks did the girls buy?
7+5+6+8=

1

E On Saturday Bob read 3 stories in his new book. He read 6 more stories on Monday and 8 more stories on Tuesday. He read how many stories in his new book?
3+6+8=

F Bill had 7¢. He earned 8¢ yesterday and 9¢ today. Now he has how much money?
7+8+9=

G 5+4+6+3=
H 8+7+9=
I 9+5+6+4=
J 7+8+3=
K 4+9+5+2=
L 6+4+8=

2

M 4+8+7+6=
N 7+9+3+5=
O 9+4+8=
P 8+5+7+2=
Q 6+8+9+9=
R 4+7+6=

2

A 3+1+8+4=
B 7+5+2+9=
C 5+4+8=
D 1+9+3+6=
E 6+5+4+7=
F 8+4+9=

Now you should understand how to add two or more numbers with one figure in them.

Keeping skillful

Find the sum.

3

A 3, 8, 7
B 9, 4, 2, 6
C 7, 7, 6, 3
D 8, 7, 6, 5
E 5, 9, 8, 7
F 6, 9, 8
G 4, 8, 3, 5
H 5, 6, 9
I 8, 7, 8
J 5, 3, 7, 9
K 8, 6, 2
L 3, 9, 8
M 7, 9, 5, 9
N 6, 8, 8
O 4, 9, 7, 9
P 5, 7, 8, 5
Q 7, 7, 5, 5
R 9, 2, 4

4

A 24+7=
B 18+3=
C 85+5=
D 40+2=
E 77+6=
F 94+5=
G 38+4=
H 10+8=
I 11+9=
J 52+7=
K 60+5=
L 12+6=
M 35+9=
N 82+7=
O 49+6=
P 14+7=
Q 56+8=
R 91+3=
S 15+6=
T 28+5=

159

159

1 Have pupils continue to work independently on these problems. Tell them they may add from left to right in the equation, if they wish, or they may write the numbers in computational form and then add.

2 Ask pupils to write the numbers in each equation in computational form and add.

3 Use this "Keeping skillful" exercise as a separate activity. Tell pupils they are to write the answers for Exercises A to R. Explain the word *sum*. Tell them to imagine that there is a plus sign where each comma is and to add from left to right if they can. If not, they may copy the figures in computational form and then add.

4 First use these exercises for oral work. Then have pupils write the answers beside their identifying letters.

160-163 Learning how

Expanded Notes for this lesson are on pages 287-288.

Objectives

The child learns to add two-figure numbers involving carrying.

Vocabulary

New words page 160 over*; page 162 any*, card

Comments

In this lesson the first problem children meet that requires them to add numbers with two figures introduces them to the need for carrying.

Addition is begun with carrying so that, at the very beginning, the child gets a general idea of the whole addition process. Right at the start he focuses on the relation between the columns. When addition without carrying is taught first, this important relation is apt to be ignored by the pupil. He sees no reason why he should add the ones first, since without carrying he can add either tens or ones first and get the answer.

Zero in addition does not become a special difficulty for the child. He learns to pass over it in the column and to go on to the next figure. The picture on page 162 helps him use zero naturally in the answer.

The children should work under your guidance in the SEE and THINK steps. Then you should encourage them to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

Answers

Page 163:

(block 1)

A 82	E 95	I 58	M 167	Q 164	U 99
B 58	F 129	J 161	N 91	R 144	V 15
C 93	G 57	K 110	O 100	S 93	
D 114	H 141	L 113	P 60	T 60	

(block 2)

A 74	C 167	E 78	G 73	I 148
B 59	D 135	F 163	H 187	J 49

Learning how

In this lesson you will learn how to add numbers with two figures in them.

see

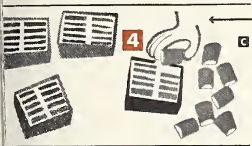
Ann bought 28 candy bars for her party. Betty bought 19 candy bars for Ann's party. How many candy bars did the girls buy for the party? 1

$28+19=\square$ You must find this number.

Put 9 candy bars with 8 candy bars.

Add the ones. There are 17 ones.

$$\begin{array}{r} 28 \\ 19 \\ \hline \end{array}$$ 3



Put 10 of the 17 candy bars in a box. You have 7 candy bars left over.

$$\begin{array}{r} 28 \\ 19 \\ \hline 7 \end{array}$$

17 is 1 ten 7 ones.

Write 7 here to show that there are 7 ones in the answer. 5

Put the new box of 10 with the other boxes of 10.

$$\begin{array}{r} {\scriptstyle 1} \\ 28 \\ 19 \\ \hline 7 \end{array}$$

Write 1 in tens' place to show that there is 1 more ten. 6

Put the boxes of 10 together.

Add the tens. There are 4 tens.

$$\begin{array}{r} {\scriptstyle 1} \\ 28 \\ 19 \\ \hline 47 \end{array}$$ 2

Write 4 here to show that there are 4 tens in the answer.

The girls bought 47 candy bars in all.

$28+19=47$ 3

think

Ellen had 26 jacks, and Betty had 24 jacks. The two girls had how many jacks altogether? 4

$26+24=\square$ You must find this number.

What do you put together first?

What do you add first? How many ones are there? 5

$$\begin{array}{r} 26 \\ 24 \\ \hline \end{array}$$

Now turn the page.

160

1 Have pupils read the problem. Tell them to look at Picture A to "see" the problem situation. Have them point to Ann's candy bars; then Betty's. Ask them what they are to find. Discuss the equation in terms of the problem.

2 Direct attention to the picture and have the children observe that the single candy bars are being put together (added).

3 Now direct attention to the computation. Compare the numerals with those in the equation above. Explain that the numerals in the ones column stand for the single candy bars that are being put together and that these numerals should be added first.

4 Let the children observe that 10 of the 17 candy bars are being made into a box of 10 and that 7 candy bars are left over.

5 Be sure they think of the 17 as 1 ten and 7 ones with the 7 standing for 7 candy bars.

6 The children should understand that the "carried" 1 stands for the new box of 10.

161

1 Have pupils observe that the boxes of 10 are being put together.

2 Explain that we are now working with the numerals that stand for the boxes of 10 candy bars. Be sure the children add the tens. Compare the 4 tens in the answer with the boxes in the picture.

3 Ask pupils to read the statement. Then have them look at the equation. Help them discover that it is the one they started with, but that now it contains the answer.

4 Tell pupils that with this problem the only guidance they will get in the book is questions to help them think. Have them read the problem, look at the picture, and then explain the equation.

5 Have the pupils read the first question and use the picture to answer it. Then have them read the questions about the example and answer them. Help them see that Picture B shows what is being added first.

What do you do with the 10 jacks?
C Are any jacks left over?

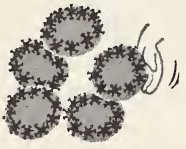
1
$$\begin{array}{r} 26 \\ 24 \\ \hline 0 \end{array}$$

← Why do you write 0 here?

What do you do with the new card of 10 jacks? 2

D
$$\begin{array}{r} {\scriptstyle 1} \\ 26 \\ 24 \\ \hline 0 \end{array}$$

← Why is 1 put here?



What do you put together now?
E
What do you add now? How many tens are there?

3
$$\begin{array}{r} {\scriptstyle 1} \\ 26 \\ 24 \\ \hline 50 \end{array}$$

What does the 5 show?

F
The girls had ■ jacks.

$26 + 24 = ■$ 4

162

try

A Betty bought 3 boxes of cookies for a party. There were 38 cookies in one box, 30 cookies in another box, and 24 cookies in the third box. How many cookies did Betty buy?
$38 + 30 + 24 = ■$ 1

$$\begin{array}{r} {\scriptstyle 1} \\ 38 \\ 30 \\ 24 \\ \hline 92 \end{array}$$

← Either remember this ten or write it. 2

3

B $41 + 70 + 58 = ■$

$$\begin{array}{r} 41 \\ 70 \\ 58 \\ \hline 169 \end{array}$$

← Here the sum of the tens is 16. 16 tens equal 1 hundred and 6 tens. So the answer has three figures.

C $63 + 34 = ■$

$$\begin{array}{r} 63 \\ 34 \\ \hline 97 \end{array}$$

D $54 + 8 + 63 = ■$

$$\begin{array}{r} 54 \\ 8 \\ 63 \\ \hline 125 \end{array}$$

do

A Ellen had 57 pennies. Her father gave her 25 more pennies. How many pennies did Ellen have then?
$57 + 25 = ■$ 4

B Mary has 20 paper dolls. Carol has 38 paper dolls. The two girls have how many paper dolls in all?
$20 + 38 = ■$

5

C $17 + 76 = ■$	M $86 + 34 + 47 = ■$	A $40 + 34 = ■$
D $69 + 45 = ■$	N $36 + 55 = ■$	B $19 + 18 + 22 = ■$
E $14 + 81 = ■$	O $50 + 26 + 24 = ■$	C $52 + 27 + 88 = ■$
F $76 + 53 = ■$	P $18 + 42 = ■$	D $97 + 38 = ■$
G $48 + 9 = ■$	Q $59 + 44 + 61 = ■$	E $30 + 24 + 24 = ■$
H $74 + 26 + 41 = ■$	R $35 + 82 + 27 = ■$	F $59 + 61 + 43 = ■$
I $3 + 18 + 37 = ■$	S $47 + 46 = ■$	G $28 + 9 + 36 = ■$
J $89 + 32 + 40 = ■$	T $35 + 25 = ■$	H $82 + 47 + 58 = ■$
K $57 + 28 + 25 = ■$	U $60 + 39 = ■$	I $73 + 75 = ■$
L $50 + 48 + 15 = ■$	V $21 + 95 + 36 = ■$	J $29 + 6 + 14 = ■$

Now you should be able to add any numbers with two figures in them.

162

1 Pupils should see that Picture C shows the answer to the first question. Direct attention to the example and be sure they add the ones. Have them answer the question about why the 0 has been written. [There are no ones, as shown in Picture C.]

2 Have pupils read the first question and look at the picture to see the action carried out. Have them read the second question and refer to the picture in answering it.

3 As the children study this picture and the work opposite it, be sure they relate the numerals in the tens' column to the objects in the picture. Be sure they understand that the addition (of the tens) is shown with action in the picture. Take special care to see that they think of 5 in the answer as 5 tens and of the cards of jacks in the picture as 5 cards of 10.

4 Have pupils read the statement and equation opposite Picture F, saying the missing numbers

163

1 Tell pupils to read the problem and look at the equation. Then tell them to write the figures in a column and add.

2 Tell them to look at this computation after they are through with their own work. Explain that they should use this computation as a means of discovering whether or not they have added correctly.

3 Have the pupils work Exercises B, C, and D on their papers and then compare their work and answers with the computation in the text. Be sure they understand why there are three figures in two of the answers.

4 Tell the class to work Exercises A to V. They should copy the numbers in computation form and add. Provide answers and let pupils verify their answers. Give individual help where it is needed.

5 For those who need extra practice, assign these exercises as written work.

164-169 Learning how

Exponded Notes for this lesson ore on pages 288-289.

Objectives

The child learns to add three-figure numbers.

Vocabulary

New words page 165 pile*; page 169 morning*, afternoon*

Comments

Children have already been introduced to all they need o know to add three-figure numbers. They have learned o change 10 ones to 1 ten. All that is new is that they nust now carry twice in the same example. The second ime they carry, they change 10 tens to 1 hundred. Ex- eriences in seeing 10 tens regrouped as hundreds in arlier lessons should have prepared them to do this asily.

The four-step method is again used in presenting e new material. The SEE step of the four-step teach- g method, with pictures and explanations, begins on age 164 and is completed on page 166. The THINK step, with pictures and questions, appears on pages 167 and 168. The TRY and DO steps, with worked-out examples and exercises, are on page 169. The device of dimming off the portions of the illustrations not under discussion is used throughout.

The children should work under your guidance in the SEE and THINK steps. Then you should encourage them to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

Answers

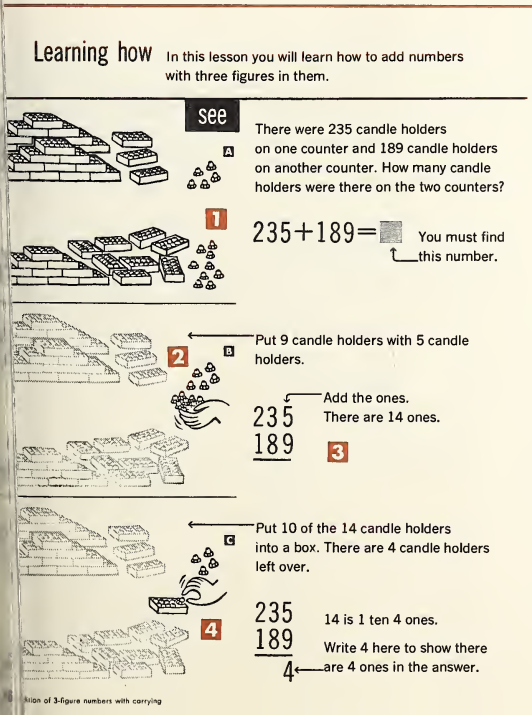
Page 169:

(block 1)

A 195	D 610	G 921	J 1110	M 990	P 702
B 481	E 229	H 1208	K 370	N 1298	
C 1058	F 930	I 1717	L 340	O 556	

(block 2)

A 1600	C 918	E 1438	G 1272
B 915	D 579	F 703	


Learning how
In this lesson you will learn how to add numbers with three figures in them.
see
A
There were 235 candle holders on one counter and 189 candle holders on another counter. How many candle holders were there on the two counters?
1
235+189=
You must find this number.
B
2
Put 9 candle holders with 5 candle holders.
Add the ones.
There are 14 ones.
235
189
3
C
Put 10 of the 14 candle holders into a box. There are 4 candle holders left over.
4
235
189
4
14 is 1 ten 4 ones.
Write 4 here to show there are 4 ones in the answer.

tion of 3-figure numbers with carrying

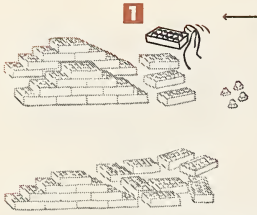
164

1 Have the pupils read the problem and the equation. Ask them to see" how the problem is shown in Picture A. Be sure they identify each number with its group of objects.

2 Direct the pupils to look at the picture to see that the ones are being put together. They should be told to ignore the part of the picture that is dimmed off.

3 Now direct attention to the computational form and relate the numerals in the ones column to the groups involved in the action in the picture. Ask, "How does adding 9 to 5 make you think of what is happening in the picture?"

4 Have a child tell what is being done in Picture C. Then have him think of 14 (the sum of 5 and 9) as 1 ten and 4 ones. Ask: "What shows this in the picture? What part of the picture shows what the 4 in the answer stands for?"



D Put the new box of 10 candle holders with the other boxes of 10.

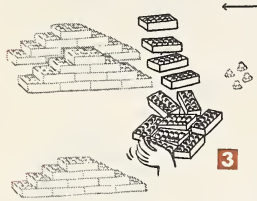
$$\begin{array}{r} {}^{1} \\ 235 \\ 189 \\ \hline 4 \end{array}$$

Write 1 in tens' place to show there is 1 more ten.

E Now put the boxes of 10 together.

$$\begin{array}{r} {}^{1} \\ 235 \\ 189 \\ \hline 4 \end{array}$$

Add the tens. There are 12 tens.

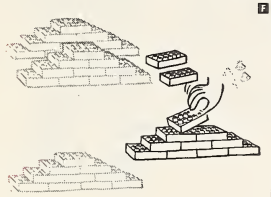


F Put 10 of the 12 boxes of ten in a pile of 100 candle holders. There are 2 boxes of 10 left over.

$$\begin{array}{r} {}^{1} \\ 235 \\ 189 \\ \hline 24 \end{array}$$

12 tens equal 1 hundred 2 tens.

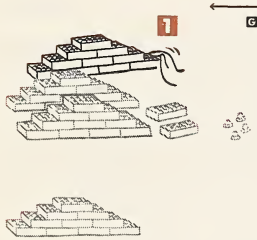
Write 2 here to show there are 2 tens in the answer.



Now turn the page.

165

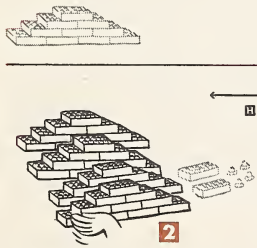
1. Get the pupils to observe that the new box of 10 is being put with the other tens.
2. Draw attention to the "carried" 1 and relate it to the new box in the picture. Ask, "Why is this 1 put in tens' place?" Be sure they think of it as 1 ten.
3. Draw attention to the combining of the boxes of 10. Ask, "How many tens are there?"
4. Now study the computation. Ask: "What does each figure in the tens' column stand for? How does the picture show what adding them means?"
5. Be sure the pupils know that there are 12 tens. Then let them explain what is being done with 10 of these 12 tens.
6. Ask: "Why do we write 2 in the answer? Does it mean 2 ones or 2 tens? How does the picture show that 2 is correct for the tens?"



G Put the new pile of 100 with the other hundreds.

$$\begin{array}{r} {}^{1\,1} \\ 235 \\ 189 \\ \hline 24 \end{array}$$

Write 1 in hundreds' place to show that there is 1 more hundred.

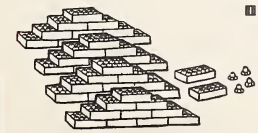


H Put the piles of 100 together.

$$\begin{array}{r} {}^{1\,1} \\ 235 \\ 189 \\ \hline 424 \end{array}$$

Add the hundreds. There are 4 hundreds.

Write 4 in hundreds' place in the answer.



I There are 424 candle holders in all.

$235 + 189 = 424$

166

1. Have pupils note that the new pile of 100 is being put with the other hundreds. Ask questions to help them see that the "carried" 1 in the hundreds' column stands for the new pile of 100 and that putting the 1 in hundreds' place corresponds to putting the new pile with the other piles of 100.
2. Let one child explain the picture.
3. Let another child add the hundreds orally.
4. Be sure the children understand what part of the picture each numeral in the answer stands for. Relate the equation to the one on page 164.

think

A

There are 150 birthday candles on one shelf in the store and 380 birthday candles on another shelf. How many candles are there in the store?

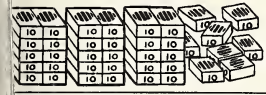
$150+380=\blacksquare$ You must find this number.

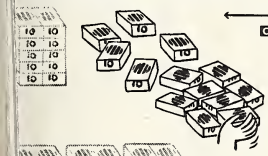
B

Are there any candles to put together that are not in boxes?

$$\begin{array}{r} 150 \\ 380 \\ \hline 0 \end{array}$$

Why must you write 0 here?





C

What do you put together first?

$$\begin{array}{r} 150 \\ 380 \\ \hline 0 \end{array}$$

What do you add? How many tens are there?

3

Now turn the page.

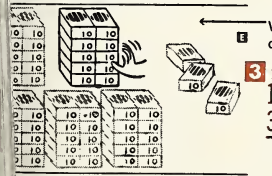
167

D

What do you do with the 13 boxes of 10 candles?

$$\begin{array}{r} 150 \\ 380 \\ \hline 30 \end{array}$$

Why do you write 3 here?

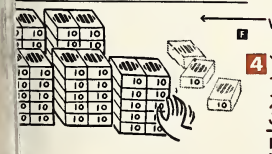


E

What do you do with the new pile of 100 candles?

$$\begin{array}{r} {\scriptstyle 1} \\ 150 \\ 380 \\ \hline 30 \end{array}$$

Why do you write the 1 here?



F

What do you put together now?

$$\begin{array}{r} {\scriptstyle 1} \\ 150 \\ 380 \\ \hline 530 \end{array}$$

Now what do you add? How many hundreds are there?

What does this 5 show?

G

There are $\blacksquare$ candles in the store.

$150 + 380 = \blacksquare$

5

167

1 Tell pupils that in this THINK step they will have pictures and questions to help them but that they will have to do their own thinking. Direct attention to the problem, the equation, and Picture A.

2 Study this example with the children. Direct attention to the numerals in the ones' column. Then ask, "Why are there only zeros in the ones' column?" [There are no single birthday candles in Picture B.]

3 Ask the children what is happening in Picture C.

4 Let the children add the tens in the example.

168

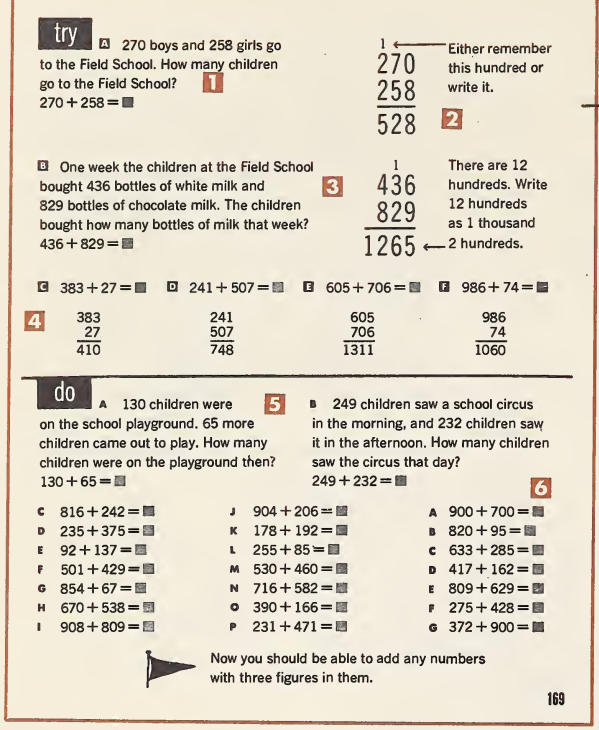
1 Ask the children what is being done with the 13 boxes of ten in the picture.

2 Relate the 3 (tens) in the answer to the boxes in Picture D. Be sure the pupils know that it is put there for the 3 in the sum [13 tens].

3 Have someone explain how the "carried" numeral 1 in the hundreds' column is shown in Picture E [the putting of the new pile of 100 with the other piles of 100].

4 Let a child add the hundreds orally and explain how the picture shows what adding the hundreds means so far as the problem is concerned.

5 Be sure the children understand what part of the picture each numeral in the answer stands for. Relate the equation to the one on page 167 and to the problem.



try

A 270 boys and 258 girls go to the Field School. How many children go to the Field School? 1
270 + 258 = ■

1 ← Either remember this hundred or write it.
270
258
528 2

B One week the children at the Field School bought 436 bottles of white milk and 829 bottles of chocolate milk. The children bought how many bottles of milk that week? 3
436 + 829 = ■

1
436
829
1265 ← 2 hundreds.

There are 12 hundreds. Write 12 hundreds as 1 thousand

C 383 + 27 = ■ D 241 + 507 = ■ E 605 + 706 = ■ F 986 + 74 = ■ 4

383 + 27 = 410
241 + 507 = 748
605 + 706 = 1311
986 + 74 = 1060

do

A 130 children were on the school playground. 65 more children came out to play. How many children were on the playground then? 5
130 + 65 = ■

B 249 children saw a school circus in the morning, and 232 children saw it in the afternoon. How many children saw the circus that day?
249 + 232 = ■ 6

C 816 + 242 = ■
D 235 + 375 = ■
E 92 + 137 = ■
F 501 + 429 = ■
G 854 + 67 = ■
H 670 + 538 = ■
I 908 + 809 = ■

J 904 + 206 = ■
K 178 + 192 = ■
L 255 + 85 = ■
M 530 + 460 = ■
N 716 + 582 = ■
O 390 + 166 = ■
P 231 + 471 = ■

A 900 + 700 = ■
B 820 + 95 = ■
C 633 + 285 = ■
D 417 + 162 = ■
E 809 + 629 = ■
F 275 + 428 = ■
G 372 + 900 = ■

Now you should be able to add any numbers with three figures in them.

169

169

1 Tell pupils to read this problem and on their papers write the equation that they think will help them solve the problem. Then have them compare it with the equation in the book. Tell them to write the figures in computational form and add to get the answer.

2 When they have finished adding, tell them to compare their work with the computation shown here. Encourage them to ask for help if they do not get the correct answer.

3 Tell pupils to work this problem in the same way. Be sure the children understand why the answer has a figure in the thousands' column.

4 Pupils should proceed with Exercises C to F independently of your help.

5 Tell the pupils to proceed with Exercises A to P. When all have finished, give them an opportunity to verify their answers.

6 Exercises A to G may be assigned as extra work for those who need it.

170-172 Learning how

Exponded Notes for this lesson are on pages 289-290.

Objectives

The child learns how to add numbers that represent amounts of money.

Vocabulary

New words page 170 points*, line*

Old words page 170 just*

Comments

Children learn that numbers that represent amounts of money are added in the same way as any other two-figure and three-figure numbers. First they learn to think of amounts of money in terms of cents. Then they compute in exactly the same way as in regular addition of two-figure and three-figure numbers. They then write the amounts of money using the dollar sign and point and learn to keep the points in line vertically in their computation. Finally, they learn that the dollar sign is written with only the first amount and the total.

The children should work under your guidance in the SEE and THINK steps. Then you should encourage them to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

Answers

Page 172:

(block 1)

A $.67	G $5.96	M $.25	S $1.1
B $1.79	H $1.09	N $.98	T $4.2
C $2.25	I $.93	O $2.56	U $.78
D $1.26	J $1.43	P $1.47	
E $1.45	K $1.64	Q $.54	
F $.63	L $1.24	R $5.26	

(block 2)

A $6.17	D $10.05	G $7.02	J $.93
B $2.00	E $4.31	H $.72	K $6.8
C $2.57	F $1.77	I $2.08	

Learning how

Now you will learn how to add amounts of money, using numbers that mean dollars and cents.

see

A

Mary had 53¢. Her mother gave her 28¢ more. Then Mary had how much money? 1

2

53¢+28¢=■ You must find this number. 3

53
28 4 Add just as you do with any numbers. When you add 53 and 28, your answer is 81.
81 ← You know that 81 means 81¢.

B

When you add amounts of money, you write the numbers with points and dollar signs.

5

$.53+$.28=■ 6

Keep the points in a line one under the other.

$.53
$.28 Remember to put a point and dollar sign in the answer.
$.81 ←

← Mary had $.81.
$.53 + $.28 = $.81

Addition of money

think

A

Don earned $1.85 Monday afternoon. He earned $.79 on Tuesday morning. How much money did he earn altogether? 1

2

$1.85+$.79=■ You must find this number.

3

185 ← You can think of these numbers
79 ← as meaning cents.
264 ← 264 means 264 cents or ■ dollars and ■ cents.

B

When you add amounts of money, how should you write the numbers? 4

What must you remember about the points?

$1.85
$ .79 What do you write in your answer?
$2.64 ←

← How much did Don earn?
$1.85 + $.79 = ■

5

170

1 Ask pupils to read this problem.

2 Call on someone to point out the coins that equal 53¢ and those that equal 28¢. Ask him to count the money in each group orally.

3 Ask pupils to relate this equation to the problem and picture.

4 Let the pupils discuss the computation. Be sure they see that the numbers are added in the usual way.

5 Point out that this picture shows the groups of money in Picture A combined and rearranged. Have a pupil count the money. Ask pupils to read the statement. Ask someone to write 53¢ and 28¢ with dollar signs and points on the board.

6 Help pupils see that this equation and the computation have the same numbers as those above. They should see that the only difference is the use of the dollar sign and point.

171

1 Ask pupils to read this problem silently.

2 Have someone count the money in each group. Then ask him to identify each group with the amounts in the problem.

3 Ask a child to read the equation. Get the children to change $1.85 and $.79 into cents. Have them add and then change 264 cents into dollars and cents.

4 Tell pupils to read and answer this question and then look at the example. Ask what is different about the way the money is written here. Stress the importance of keeping the points in a straight line. Tell pupils to add and compare their answers with the answer in the book. Discuss the dollar sign and point in the answer.

5 Have a pupil count the money in Picture B. Get pupils to observe that this picture shows the money from Picture A arranged to fit the figures in the answer.

try

A Jack has 63¢. Tom has 57¢. The two boys have how much money in all?
$.63 + $.57 = ■ 1

You do not need to write this dollar sign. →

$$\begin{array}{r} \$\ .63 \\ \$\ .57 \\ \hline \$1.20 \end{array}$$ 2

B Betty spent 26¢ for a toy, 15¢ for candy, and 92¢ for a pen. How much money did she spend altogether?
$.26 + $.15 + $.92 = ■ 3

$$\begin{array}{r} \$\ .26 \\ .15 \\ .92 \\ \hline \$1.33 \end{array}$$

C $1.18 + $2.21 = ■ D $.09 + $.81 + $.42 = ■ E $1.37 + $.98 = ■ 4

$$\begin{array}{r} \$1.18 \\ 2.21 \\ \hline \$3.39 \end{array} \qquad \begin{array}{r} \$\ .09 \\ .81 \\ .42 \\ \hline \$1.32 \end{array} \qquad \begin{array}{r} \$1.37 \\ .98 \\ \hline \$2.35 \end{array}$$

do Add 5

A 12¢, 35¢, 20¢
B $1.42, $.16, $.21
C $.74, $.82, $.69
D 37¢, 24¢, 65¢
E 52¢, 85¢, 8¢
F 19¢, 32¢, 12¢
G $2.18, $3.41, $.37
H 33¢, 41¢, 35¢
I $.14, $.79
J 67¢, 22¢, 54¢

K 94¢ + 52¢ + 18¢ = ■
L $.10 + $1.14 = ■
M 12¢ + 8¢ + 5¢ = ■
N 76¢ + 22¢ = ■
O $1.32 + $1.24 = ■
P 75¢ + 60¢ + 12¢ = ■
Q $.45 + $.09 = ■
R $5.10 + 16¢ = ■
S 22¢ + 89¢ = ■
T $.80 + $3.45 = ■
U 24¢ + 54¢ = ■

A $3.15 + $1.20 + $1.82 = ■ 6
B 65¢ + 38¢ + 97¢ = ■
C $1.35 + $.18 + $1.04 = ■
D $2.88 + $7.17 = ■
E $.75 + $3.12 + $.44 = ■
F $1.50 + 16¢ + 11¢ = ■
G $4.99 + $.56 + $1.47 = ■
H $.21 + $.45 + $.06 = ■
I $1.24 + $.06 + $.78 = ■
J $.66 + $.19 + $.08 = ■
K $2.26 + $3.40 + $1.17 = ■

Now you should be able to add amounts of money.

172

1 Tell pupils to read this problem and on their papers write the equation that states the problem situation. Then tell them to write the numbers in a column and add.

2 Have the children compare their work and answer with the example in the book. Point out that from now on they need write the dollar sign only in front of the first number and the sum.

3 Pupils should proceed in the same way with this problem.

4 Pupils should work Exercises C, D, and E, then compare their work with that in the book.

5 Assign Examples A to U as written work. Remind pupils not to forget the dollar signs and points.

6 Assign these exercises as extra work for those who need it.

173 Checking up; Keeping skillful

Expanded Notes are not considered necessary for these lessons.

Objectives

The child tests his ability to add.

Vocabulary

There are no new words in this lesson.

Comments

Treat this series of "Checking up" tests as you have other end-of-block tests. Give children ample time to complete all the work. Give as many of the six tests during one class period as you feel are advisable for your particular group of children. Tell pupils to copy the labeling letter for each exercise. For Test 1 tell them to write the answers only. For the remaining tests tell them to write the figures in column form and add. These tests are designed to help you diagnose individual difficulties and find out where reteaching is necessary.

The "Keeping skillful" exercises should be handled as a separate activity.

Answers

Test 1		Test 2		Test 3	
A 43	E 58	A 17	E 18	A 67	E 116
B 36	F 20	B 16	F 21	B 64	F 140
C 69	G 62	C 19	G 23	C 70	G 118
D 100	H 81	D 25	H 24	D 182	H 105

Test 4		Test 5		Test 6	
A 89	E 183	A 873	E 805	A $3.95	E $3.63
B 87	F 203	B 683	F 842	B $1.74	F $1.46
C 61	G 143	C 958	G 1800	C $1.55	G $7.60
D 89	H 174	D 864	H 1115	D $7.83	H $13.4

Keeping skillful:

(block 1)

A 3 tens 12 ones	E 7 tens 17 ones	I 8 tens 11 one
B 2 tens 19 ones	F 5 tens 18 ones	J 2 tens 13 on
C 6 tens 10 ones	G 1 ten 14 ones	K 6 tens 15 on
D 4 tens 16 ones	H 3 tens 10 ones	

Checking up

Test 1 1

A 35 + 8 = ▢
B 27 + 9 = ▢
C 64 + 5 = ▢
D 97 + 3 = ▢
E 49 + 9 = ▢
F 16 + 4 = ▢
G 53 + 9 = ▢
H 74 + 7 = ▢

Test 2 2

A 4 + 5 + 8 = ▢
B 7 + 1 + 5 + 3 = ▢
C 6 + 4 + 7 + 2 = ▢
D 3 + 9 + 5 + 8 = ▢
E 3 + 5 + 6 + 4 = ▢
F 8 + 7 + 6 = ▢
G 9 + 9 + 5 = ▢
H 8 + 6 + 7 + 3 = ▢

Test 3 3

A 22 + 45 = ▢
B 36 + 28 = ▢
C 53 + 17 = ▢
D 89 + 93 = ▢
E 70 + 46 = ▢
F 65 + 75 = ▢
G 82 + 36 = ▢
H 58 + 47 = ▢

Test 4

A 32 + 14 + 43 = ▢
B 50 + 15 + 22 = ▢
C 15 + 19 + 27 = ▢
D 30 + 28 + 31 = ▢
E 62 + 76 + 45 = ▢
F 88 + 75 + 40 = ▢
G 57 + 62 + 24 = ▢
H 95 + 48 + 31 = ▢

Test 5 5

A 341 + 532 = ▢
B 426 + 257 = ▢
C 580 + 378 = ▢
D 816 + 48 = ▢
E 749 + 56 = ▢
F 467 + 375 = ▢
G 921 + 879 = ▢
H 618 + 497 = ▢

Test 6

A $1.45 + $2.50 = ▢
B $.76 + $.98 = ▢ 6
C $.30 + $.79 + $.46 = ▢
D $5.00 + $2.83 = ▢
E $2.68 + $.95 = ▢
F 57¢ + 18¢ + 71¢ = ▢
G $4.25 + $3.35 = ▢
H $8.03 + $5.46 = ▢

Keeping skillful

A 42 = 3 tens ▢ ones
B 39 = ▢ tens 19 ones
C 70 = ▢ tens ▢ ones
D 56 = ▢ tens ▢ ones
E 87 = ▢ tens ▢ ones
F 68 = ▢ tens ▢ ones
G 24 = ▢ ten ▢ ones
H 40 = ▢ tens ▢ ones
I 91 = ▢ tens ▢ ones
J 33 = ▢ tens ▢ ones
K 75 = ▢ tens ▢ ones

8

A 3 quarts = ▢ pints
B 5 yards = ▢ feet
C 3 gallons = ▢ quarts
D 9 feet = ▢ yards
E 8 pints = ▢ quarts
F 2 yards = ▢ feet
G 8 quarts = ▢ pints
H 16 quarts = ▢ gallons
I 2 gallons = ▢ pints
J 12 pints = ▢ quarts
K 12 feet = ▢ yards

9

A 18 ÷ 9 = ▢
B 16 ÷ ▢ = 4
C 12 ÷ ▢ = 2
D 18 ÷ 6 = ▢
E 14 ÷ 7 = ▢
F 10 ÷ ▢ = 5
G 15 ÷ 3 = ▢
H 16 ÷ ▢ = 2
I 12 ÷ 3 = ▢
J 18 ÷ 2 = ▢
K 15 ÷ 5 = ▢

End-of-block tests on addition 173

173

1 Test on adding one-figure numbers to two-figure numbers (taught on pages 153 to 155)
2 Test on column addition of one-figure numbers (taught on pages 156 to 159)
3 Test on addition of two two-figure numbers (taught on pages 160 to 163)
4 Test on column addition of three two-figure numbers (taught on page 163)
5 Test on adding three-figure numbers (taught on pages 164 to 169)
6 Test on addition of money (taught on pages 170 to 172)
7 Under headings *tens* and *ones* and opposite the labeling letters, have pupils write the numbers. Tell them that for each exercise they should change one of the tens and put it with the ones. Note that A and B are partially completed.
8 You may require pupils to write an equation for each exercise, or just to give the answer.
9 Have pupils say or write the missing numbers.

174-175 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child solves problems of all the types studied so far.
He reviews basic facts and money equivalents.

Vocabulary

New words page 174 fair, sell*, crayons, stamps*
Old words page 174 mice

Comments

"Using arithmetic" should be assigned as written work. If the children have acquired the skills already taught, they will have no difficulty in translating these problems into the proper equations and computing correctly. The "Keeping skillful" exercises should be treated as a separate activity.

Answers

Using arithmetic:

A 240 + 261 = [501] or 261 + 240 = [501]
B 3 × 6¢ = [18¢]
C 15¢ − 6¢ = [9¢]
D $.19 + $.39 = [$.58] or $.39 + $.19 = [$.58]
E 18 ÷ 2 = [9]
F 14 − 8 = [6]
G 16 ÷ [8] = 2
H 10 − 7 = [3]
I $4.40 + $3.75 = [$8.15] or $3.75 + $4.40 = [$8.15]
J 11 − 5 = [6]
K 11 − 3 = [8]
L 2 × 8 = [16]
M 15¢ ÷ [5¢] = 3
N 12 − 7 = [5]
O 13 + 8 = [21]
P 2 × 9¢ = [18¢]
Q 16 − 7 = [9]
R 9 + [3] = 12
S 17 − 8 = [9]
T 12 + 48 = [60] or 48 + 12 = [60]
U 12 ÷ [4] = 3
V $1.15 + $.29 = [$1.44] or $.29 + $1.15 = [$1.44]
W 4 × 4 = [16]
X 3 + [5] = 8

Keeping skillful:

(block 3)

A 5 pennies
B 5 dimes
C 15 pennies
D 4 nickels
E 50 pennies
F 2 nickels
G 10 pennies
H 10 nickels
I 4 nickels
J 5 nickels
K 3 nickels
L 2 quarters
M 3 dimes
N 3 quarters

Using arithmetic 1

A 240 boys and 261 girls came to the Toy and Book Fair at the Field School. How many children came to the fair? 2

B Jim bought 3 balloons at the fair. The balloons cost 6¢ apiece. How much did all 3 balloons cost?

C Ellen bought a box of crayons for 15¢ and a balloon for 6¢. The balloon cost how many fewer cents than the crayons?

D Dick spent 19¢ for a whistle and 39¢ for a puzzle. How much did he spend for the two toys? 2

E At the fair a girl put 18 doll chairs into boxes. She put 2 doll chairs into each box. How many boxes did she use?

F The girl had 14 games to sell. She sold 8 of them. How many games did she have left?

G Tom bought a package of 16 airplane stamps. He shared them equally with Bill. How many stamps did each boy get?

H Don bought 7 little books. Mary bought 10 little books. Don bought how many fewer books than Mary?

I Carol's father spent $4.40 for books and $3.75 for toys. How much did he spend for books and toys? 2

J Carol's father bought 5 books and 11 toys at the fair. He bought how many more toys than books?

K Carol's father gave 3 of the 11 toys to Carol and the other toys to Jack and Don. How many toys did he give to Jack and Don?

L Jack bought 2 boxes of pencils at the fair. Each box had 8 pencils in it. How many pencils did he buy?

M Nancy paid fifteen cents for a box of toy butterflies. There were three butterflies in the box. They cost how many cents apiece?

N Bob saw twelve different books about dogs and seven different books about cats. He saw how many more books about dogs than about cats?

O Betty had thirteen paper dolls at home. She bought 8 more paper dolls at the fair. Then she had how many paper dolls?

P Mary bought 2 toy mice for 9¢ apiece. How much did she pay for the two toy mice?

Q Don bought a package of 16 boat stamps. He gave 7 of them to Bob. Then Don had how many boat stamps?

R Mary had 9 doll chairs at home. She bought more at the fair. She said to June, "Now I have 12 chairs." How many doll chairs did she buy at the fair?

S At one table a girl sold 17 toy cats and 8 toy elephants. She sold how many fewer elephants than cats?

T At another table a boy sold 12 big puzzles and 48 small puzzles. How many puzzles in all did he sell? 1

U Three boys bought a box of 12 candy sticks and shared them equally. There were how many candy sticks for each boy?

V Bill paid $1.15 for a saw and $.29 for a hammer. How much did he pay for these two things? 1

W Mary's mother carried 4 packages home from the fair. There were 4 toys in each package. There were how many toys in all the packages?

X Ellen's mother wanted to buy 8 storybooks for the children. She picked out 3 books. How many more books did she need to pick out? 2

Keeping skillful 3

A	16 − 7 = ■	4 × 4 = ■
B	15 ÷ 5 = ■	13 − 7 = ■
C	2 × 6 = ■	12 ÷ 2 = ■
D	18 ÷ 3 = ■	18 − 9 = ■
E	16 − 8 = ■	16 ÷ 8 = ■
F	4 × 3 = ■	6 × 3 = ■
G	14 ÷ 7 = ■	14 − 6 = ■
H	9 × 2 = ■	3 × 4 = ■
I	16 ÷ 4 = ■	18 ÷ 2 = ■
J	15 − 8 = ■	15 ÷ 3 = ■
K	3 × 5 = ■	13 − 4 = ■
L	12 ÷ 3 = ■	14 − 9 = ■
M	17 − 9 = ■	18 ÷ 6 = ■
N	7 × 2 = ■	11 − 3 = ■

A 1 quarter = 2 dimes ■ pennies
B 1 dollar = 1 half dollar ■ dimes
C 1 quarter = 1 dime ■ pennies
D 1 half dollar = 3 dimes ■ nickels
E 1 dollar = 2 quarters ■ pennies
F 1 half dollar = 4 dimes ■ nickels
G 1 quarter = 3 nickels ■ pennies
H 1 dollar = 2 quarters ■ nickels
I 1 dollar = 8 dimes ■ nickels
J 1 half dollar = 1 quarter ■ nickels
K 1 quarter = 1 dime ■ nickels
L 1 dollar = 1 half dollar ■ quarters
M 1 half dollar = ■ dimes 4 nickels
N 1 dollar = ■ quarters 5 nickels

174

1 Direct the pupils to work independently on Problems A to X without preliminary discussion. Tell them first to write the equation for each problem situation with a screen (or square) for the number they have to find. Tell them that if they need to write the figures in computational form to find the answer, they should write this form below the equation. As a final step, they should rewrite the equation with the answer filled in.

2 Note that for this problem two equations may be made (see "Answers"). Either one is acceptable.

175

1 Either of two equations is acceptable for this problem (see "Answers").

2 After the children have finished their work provide answers with which they can compare their answers. Give individual help if it is needed. You may want to group the children in such a way that they can help one another.

3 For the "Keeping skillful" exercises, pupils may make three columns lettered A to N on their papers and write answers only. These exercises may also be used for oral response.

176-179 Learning how

Expanded Notes for this lesson are on pages 290-292.

Objectives

The child learns how to subtract a two-figure number from another two-figure number with borrowing.

Vocabulary

New words page 176 friends*, open*; page 177 bundle; page 179 baseball

Comments

Not until pupils have studied and tried several problems and examples involving borrowing do they meet an example with no borrowing. Subtraction of two-figure numbers is begun with borrowing because in subtraction without borrowing the child gets an incomplete and even incorrect idea of the subtraction process. The word *borrowing* is not used in the text, but you may decide to use it orally.

The new skill is taught by means of the four-step teaching method. Of course you will carefully direct the work for the SEE and THINK steps. Then you should encourage children to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

Use your own judgment about having children cross out numerals and write the new numerals above the work to show regrouping (for borrowing). It is usually wise to allow children to do this as long as they need to. The primary objective is to enable them to know why and how to subtract. Refinement of procedures can come later.

Answers

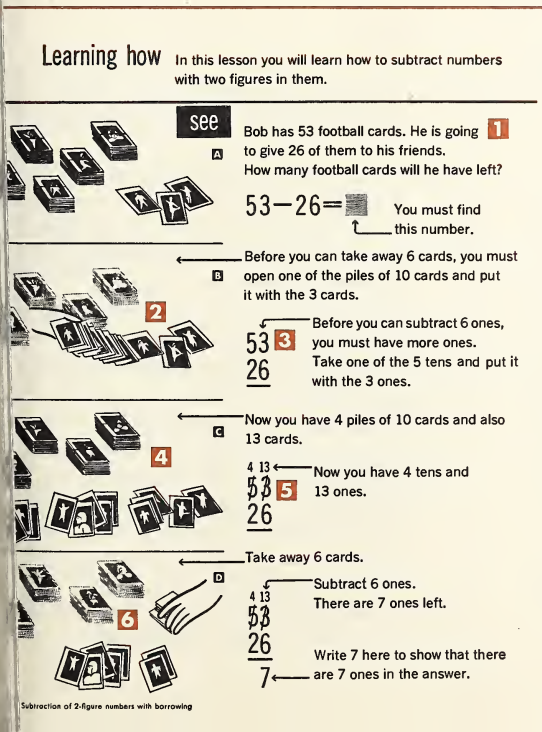
Page 179:

(block 1)

A 34	D 11	G 33	J 9	M 24	P 20	S 9
B 18	E 67	H 28	K 48	N 34	Q 9	T 47
C 27	F 60	I 20	L 38	O 34	R 41	

(block 2)

A 27	D 29	G 27	J 35	M 38	P 67
B 42	E 15	H 24	K 38	N 14	
C 66	F 48	I 49	L 30	O 8	


Learning how
In this lesson you will learn how to subtract numbers with two figures in them.
see
A
Bob has 53 football cards. He is going 1 to give 26 of them to his friends.
How many football cards will he have left?
53−26=▒
You must find this number.
B
Before you can take away 6 cards, you must open one of the piles of 10 cards and put it with the 3 cards.
2
Before you can subtract 6 ones, you must have more ones.
Take one of the 5 tens and put it with the 3 ones.
3
C
Now you have 4 piles of 10 cards and also 13 cards.
4
Now you have 4 tens and 13 ones.
5
Take away 6 cards.
D
Subtract 6 ones.
There are 7 ones left.
6
Write 7 here to show that there are 7 ones in the answer.

Subtraction of 2-figure numbers with borrowing

176

1. Ask pupils to read this problem and to look at Picture A to "see" the 53 cards. Let a child tell how many cards are in each bundle. Have another child read the equation and statement. Ask how they can take away 6 cards when there are only 3 cards not in bundles.
2. Have pupils look at the picture to see a bundle of 10 cards being opened and the 10 cards being put with the 3 cards already there.
3. Direct attention to the numerals in the ones' column and discuss the need for more ones.
4. Get the children to see that the original 5 bundles of 10 and the 3 cards are rearranged into 4 bundles of 10 and 13 cards.
5. Help the children relate the numerals 4 and 13 to the rearranged cards in the picture. Explain why the 5 and the 3 are crossed out.
6. Discuss what is happening. Get the children to see that the numerals in the ones' column stand for what is happening in the picture.

Next take away 2 piles of 10 cards.

E

Now subtract 2 tens from 4 tens. 2 tens are left.

$$\begin{array}{r} {\scriptstyle 4\ 13} \\ 5\not{3} \\ 26 \\ \hline 27 \end{array}$$

Write 2 here to show 2 tens in the answer.

F

Bob will have 27 cards left.

$53 - 26 = 27$

think

A

Ann had 60 crayons at home. She took 34 of them to school. Then she had how many crayons at home?

$60 - 34 = \blacksquare$ You must find this number.

B

Why must you open 1 bundle of 10 crayons before you can take away 4 crayons?

What must you do before you can subtract 4 ones?

$$\begin{array}{r} 60 \\ 34 \\ \hline \end{array}$$

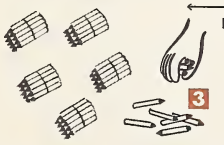
Now turn the page.

C

How many bundles of 10 crayons are there now? How many other crayons are there?

$$\begin{array}{r} {\scriptstyle 5\ 10} \\ 60 \\ 34 \\ \hline \end{array}$$

Now you have ■ tens and ■ ones.



D

How many of the 10 crayons should you take away? How many crayons are left?

$$\begin{array}{r} {\scriptstyle 5\ 10} \\ 60 \\ 34 \\ \hline 6 \end{array}$$

Subtract 4 ones from ■ ones.

What does this 6 show?

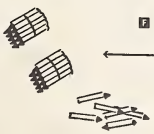
E

How many bundles of 10 crayons should you take away?

$$\begin{array}{r} {\scriptstyle 5\ 10} \\ 60 \\ 34 \\ \hline 26 \end{array}$$

Now subtract ■ tens from ■ tens.

What does this 2 show?



F

Ann had ■ crayons left at home.

$60 - 34 = \blacksquare$

177

1. Discuss the action of giving away 2 bundles of 10 cards, or 2 tens.
2. Be sure the children relate the numerals in the tens' column to the picture and understand that subtracting 2 tens corresponds to the removal of 2 piles of 10 cards.
3. Let pupils read the statement. Ask them to note the completed equation and compare the answer with the picture.
4. Let a child read this problem. Ask how many crayons are in each bundle in the picture. Relate the equation to the problem.
5. Point out that in the THINK step the class must think through what they must do in each stage of solving the problem. Ask a child to explain what is happening in the picture and why this is necessary. Ask another child to explain what 0 and 4 stand for. Discuss the need for ones and how to get them.

178

1. Examine with the children the rearrangement of the bundles of crayons and the reason for it.
2. Ask the children to explain how the changes in the arrangement of the crayons are shown by the numerals 5 and 10 in the computation.
3. Be sure the children understand that 4 of the crayons are being taken away.
4. Get pupils to see that we are now doing with the numerals what is shown in the picture. Be sure they relate the 6 in the answer to the 6 crayons left.
5. Children should understand that 30 (3 tens) of Ann's crayons are now being taken away.
6. Direct attention to the computation and discuss what is being done with the tens. Relate each numeral to the objects in the picture and the subtracting of 3 tens to the removal of 3 bundles of crayons.
7. Have a pupil complete this sentence and equation and refer back to the problem.

try

A Ann had 48 pennies. She spent 39 pennies for a large box of crayons. How many pennies did she have then? 1

48 − 39 = ■

3 18 ← Either remember 2 these figures or write them.
48
39
9

B 31 − 20 = ■ 3
31
20
11

C 52 − 37 = ■
52
37
15

D 80 − 15 = ■
80
15
65

E 97 − 5 = ■
97
5
92

do

A There were 43 puzzles in a store. A clerk sold 9 of them to the children. How many puzzles were left in the store? 4
43 − 9 = ■

B Mother put 36 cookies on a tray. The children ate 18 of them. How many cookies were left?
36 − 18 = ■ 4

C Bill had 51 baseball cards. He gave 24 of them to Jack. How many baseball cards did Bill keep?
51 − 24 = ■

D Carol had 42 pieces of candy. At a party her friends ate 31 pieces of the candy. How many pieces of candy were left?
42 − 31 = ■ 5

E 82 − 15 = ■
F 95 − 35 = ■
G 37 − 4 = ■
H 71 − 43 = ■
I 25 − 5 = ■
J 38 − 29 = ■
K 63 − 15 = ■
L 70 − 32 = ■

M 40 − 16 = ■
N 71 − 37 = ■
O 54 − 20 = ■
P 78 − 58 = ■
Q 30 − 21 = ■
R 57 − 16 = ■
S 45 − 36 = ■
T 88 − 41 = ■

A 44 − 17 = ■
B 80 − 38 = ■
C 75 − 9 = ■
D 33 − 4 = ■
E 82 − 67 = ■
F 91 − 43 = ■
G 64 − 37 = ■
H 76 − 52 = ■

I 68 − 19 = ■
J 50 − 15 = ■
K 87 − 49 = ■
L 48 − 18 = ■
M 92 − 54 = ■
N 61 − 47 = ■
O 83 − 75 = ■
P 97 − 30 = ■

Now you should know how to subtract numbers with two figures in them.

179

179

1 Have all pupils read this problem. Tell them to write on their papers the equation for solving the problem, then compare it with the one in the book. Tell them to write the figures in computational form and subtract.

2 Tell them to compare their work and answer with the computation in the book.

3 Pupils should use Exercises B to E as tryout work. Let them proceed at their own rate, comparing their work with that given in the book after they have finished each exercise.

4 Assign these problems and exercises as written work. Afterwards, provide answers with which the pupils can compare theirs. Give individual help if it seems to be needed.

5 Assign these exercises as extra practice for those who need it.

180-186 Learning how

panded Notes for this lesson are on pages 292-294.

jectives

e child learns how to subtract three-figure numbers.

cabulary

w words **page 180** chalk; **page 181** empty; **page** 6 second*

nments

s lesson begins with a problem that involves borrow- twice. The concepts learned in subtracting numbers h two figures are extended to include changing one dred into 10 tens when needed. Previous work with number system has given pupils experience in seeing dreds regrouped as tens, so they should have little iculty in understanding the use of this principle in traction.

he four-step teaching method is used. Of course you carefully direct the work for the SEE and THINK s. Then you will encourage the children to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

The dimming-off device is used again to take attention away from those parts of the illustrations not under immediate discussion.

Answers

Page 186:

(block 1)

A 246	G 409	M 270	S 32	Y 42
B 74	H 488	N 723	T 641	Z 411
C 117	I 237	O 71	U 49	
D 476	J 285	P 7	V 303	
E 635	K 449	Q 308	W 319	
F 70	L 104	R 242	X 375	

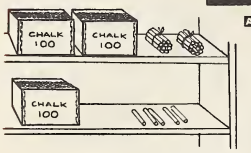
(block 2)

A 578	D 292	G 213	J 117
B 271	E 542	H 137	K 47
C 28	F 290	I 165	L 282

Learning how

In this lesson you will learn how to subtract numbers with three figures in them.

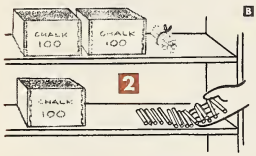
see



A

1 There were 325 pieces of chalk in the schoolroom. One month 187 pieces were used. How many pieces of chalk were left?

$325 - 187 = \square$ ← You must find this number.

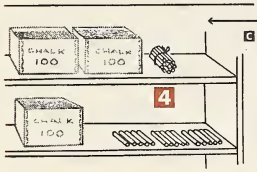


B

← Before you can take away 7 pieces of chalk, you must open one bundle of 10 pieces of chalk.

$$\begin{array}{r} 325 \\ 187 \\ \hline \end{array}$$

3 ← Before you can subtract 7 ones, you must have more ones. Take one of the 2 tens and put it with the 5 ones.



C

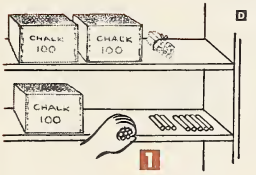
← Now you have 1 bundle of 10 pieces of chalk and also 15 pieces of chalk.

5

$$\begin{array}{r} {\scriptstyle 1\ 15} \\ 32\not{5} \\ 187 \\ \hline \end{array}$$

← Now you have 1 ten and 15 ones.

← Take away 7 pieces of chalk.



D

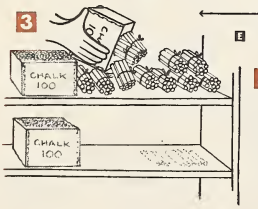
← Subtract 7 ones. There are 8 ones left.

$$\begin{array}{r} {\scriptstyle 1\ 15} \\ 32\not{5} \\ 187 \\ \hline 8 \end{array}$$

2

← Write 8 here to show there are 8 ones in the answer.

3



E

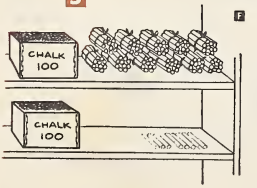
← Before you can take away 8 bundles of 10, you must empty one of the boxes of 100 pieces of chalk.

4

$$\begin{array}{r} {\scriptstyle 1\ 15} \\ 32\not{5} \\ 187 \\ \hline 8 \end{array}$$

← Before you can subtract 8 tens, you must have more tens. You will take one of the 3 hundreds and put it with the 1 ten.

5



F

← Now you have 2 boxes of 100 pieces and 11 bundles of 10 pieces.

6

$$\begin{array}{r} {\scriptstyle 11} \\ {\scriptstyle 2\ \not{3}\ 15} \\ 3\not{2}\not{5} \\ 187 \\ \hline 8 \end{array}$$

← Now you have 2 hundreds and 11 tens.

Now turn the page.

180

1 Have pupils read the problem. They should understand that the picture shows 325 pieces of chalk, which include the 187 that were used. Let them check the equation with the problem.

2 Be sure the class understands that one of the bundles of ten pieces of chalk has been opened, and the pieces are now being put with the 5 other pieces of chalk. Ask the children why this is being done.

3 Direct attention to the numerals in the ones' column. Discuss the need for more ones and point out how they can be obtained by regrouping.

4 Have the pupils examine the picture to note the result of the regrouping of the pieces of chalk [3 boxes of 100, 1 bundle of 10, and 15 single pieces of chalk].

5 Be sure the pupils relate the numerals 1 and 15 to the 1 ten and 15 ones in the picture.

181

1 Discuss the action of removing the 7 pieces of chalk as the first step of taking 187 away. Note the 8 pieces of chalk remaining.

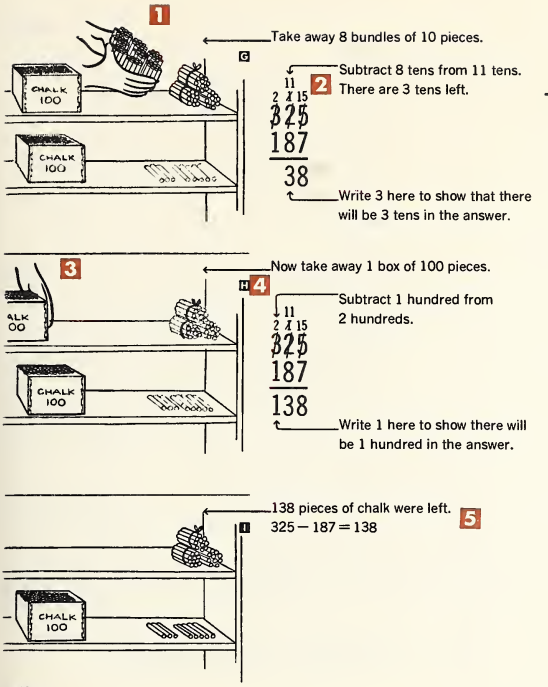
2 Have the pupils relate the numerals in the ones' column to the objects in the picture (15 to the 15 single pieces of chalk that were there, 7 to the pieces being removed, 8 to those left).

3 Direct attention to the picture and let the children discuss the reason for emptying a box of 100. Be sure they know that the box contains 10 bundles of 10.

4 Have the pupils observe that to subtract in tens' place more tens are needed. Discuss where to get them.

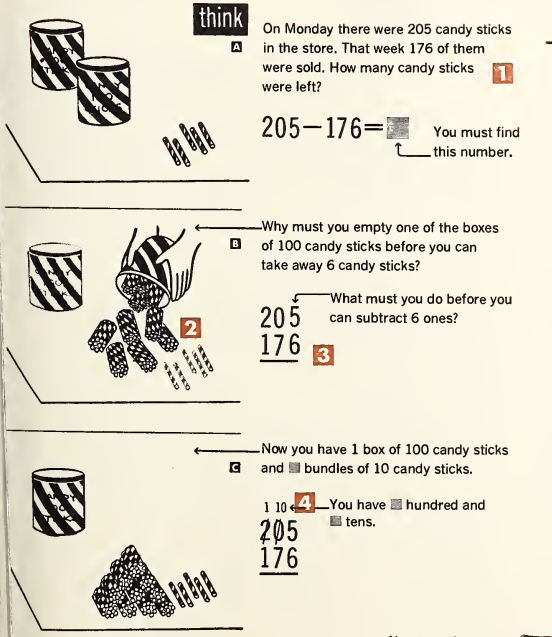
5 Pupils should note the result of the regrouping of the chalk. Center attention on hundreds and tens.

6 Relate the numerals in the hundreds' and tens columns to the picture.



182

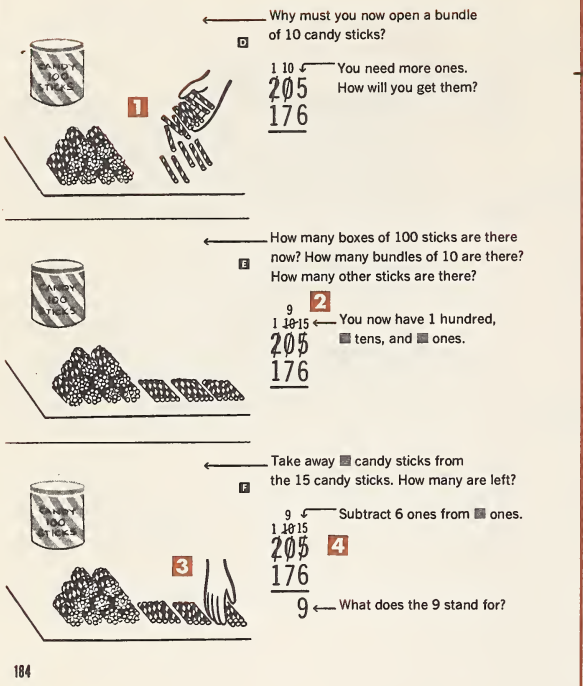
1. Discuss the action of taking away 8 bundles of 10 pieces each, or 80 pieces of chalk.
2. Relate the 11, 8, and 3 in the tens' column to the pieces of chalk in the picture.
3. Discuss the action of taking away 100 pieces of chalk.
4. Relate the numerals 2, 1, and 1 in the hundreds' column to the picture. Be sure the children observe that the subtraction of 1 from 2 corresponds to the action in the picture.
5. Compare the answer in the sentence and equation with the objects in the picture.


think
A
On Monday there were 205 candy sticks in the store. That week 176 of them were sold. How many candy sticks were left?
1
205 − 176 = ▢
You must find this number.
B
Why must you empty one of the boxes of 100 candy sticks before you can take away 6 candy sticks?
2
What must you do before you can subtract 6 ones?
205
176
3
C
Now you have 1 box of 100 candy sticks and ▢ bundles of 10 candy sticks.
1 10
4
You have ▢ hundred and ▢ tens.
205
176

Now turn the page.

183

1. Have pupils read the new problem and relate the facts in it to the picture. Tell them that they must do more of the thinking now.
2. Discuss the reasons for emptying the box of 100 candy sticks. The discussion should result in the discovery that there are no separate bundles of 10 candy sticks and the resulting necessity of breaking up a box of 100. The children should think of it as a box of 10 tens, not merely as 100 individual candy sticks.
3. Direct attention to the computation and discuss the need for more ones. Let the children discover that they will have to go to hundreds' place to get more ones.
4. Relate the "borrowed" 10 and the remaining 1 in the hundreds' column to the regrouping in the picture.


Why must you now open a bundle of 10 candy sticks?
D
1 10
205
176
You need more ones. How will you get them?
1
How many boxes of 100 sticks are there now? How many bundles of 10 are there? How many other sticks are there?
E
2
9
1 10 15
205
176
You now have 1 hundred, ■ tens, and ■ ones.
Take away ■ candy sticks from the 15 candy sticks. How many are left?
F
Subtract 6 ones from ■ ones.
3
4
176
9
What does the 9 stand for?
How many bundles of 10 candy sticks should you take away?
G
2
Now subtract ■ tens from ■ tens.
1
29
What does the 2 stand for?
Now take away a box of ■ candy sticks.
H
3
How many hundreds do you subtract?
4
You do not write a figure in hundreds' place in the answer. Why?
■ candy sticks were left.
I
205 − 176 = ■
5

184

185

184

1 Through discussion get the children to see that more single candy sticks are needed to do the taking away called for. Let them explain why the bundle of 10 is now being opened up. Be sure to discuss the numerals in the ones' column.

2 Now relate the numerals 1, 9, and 15 in the computation to the regrouping shown in the picture. The pupils should understand that no subtracting has been done as yet and that the picture shows the same number of candy sticks as Picture D. They should also understand that the numerals 1, 9, and 15 represent the same quantity that 205 does.

3 Alert the children to the fact that the 6 candy sticks can now be taken away. Discuss what is being done in this picture.

4 Relate the numerals in the ones' column (15, 6, and 9) to the objects in the picture. Be sure the pupils see that the subtraction of 6 from 15 is shown by the picture.

185

1 Make clear that 7 bundles of 10 candy sticks, or 70 candy sticks, are being taken away.

2 Relate the numerals in the tens' column (9 7, and 2) to the objects in the picture.

3 Discuss the reason for the removal of the one box of 100 candy sticks.

4 Make clear why no numeral is written in hundreds' place.

5 Ask someone to supply the missing number in this statement and equation. Let him explain the answer in terms of Picture I.

try

A It took Mary two weeks to read a new storybook. The storybook had 252 pages. The first week Mary read 138 pages. How many pages did she read the second week? **1**

252 − 138 = ■

4 12 ← Either remember these figures or write them.

2 5 2
1 3 8
1 1 4

B 674 − 256 = ■ C 806 − 337 = ■ D 732 − 582 = ■ E 417 − 68 = ■

2

674	806	732	417
256	337	582	68
418	469	150	349

do

A There were 400 pieces of drawing paper in the schoolroom. One week the children used 154 pieces. How many pieces were left? **3**

400 − 154 = ■

B Bob has 124 football and baseball stamps. 50 of them are football stamps. The others are baseball stamps. He has how many baseball stamps? **4**

124 − 50 = ■

3

C 226 − 109 = ■	O 716 − 645 = ■	A 871 − 293 = ■
D 952 − 476 = ■	P 300 − 293 = ■	B 698 − 427 = ■
E 876 − 241 = ■	Q 708 − 400 = ■	C 303 − 275 = ■
F 460 − 390 = ■	R 327 − 85 = ■	D 464 − 172 = ■
G 630 − 221 = ■	S 114 − 82 = ■	E 600 − 58 = ■
H 583 − 95 = ■	T 900 − 259 = ■	F 725 − 435 = ■
I 304 − 67 = ■	U 131 − 82 = ■	G 259 − 46 = ■
J 700 − 415 = ■	V 475 − 172 = ■	H 380 − 243 = ■
K 937 − 488 = ■	W 628 − 309 = ■	I 546 − 381 = ■
L 206 − 102 = ■	X 450 − 75 = ■	J 172 − 55 = ■
M 329 − 59 = ■	Y 726 − 684 = ■	K 924 − 877 = ■
N 831 − 108 = ■	Z 949 − 538 = ■	L 500 − 218 = ■

Now you should be able to subtract any numbers with three figures in them.

186

1 Have all pupils read this problem and write the equation that describes the situation. Tell them to rewrite the figures in computational form and find the answer. Then tell them to compare their work and answer with that in the book. It may be wise to let some children continue to write the changed numerals above the example.

2 Tell pupils to work Exercises B, C, D, and E on their papers without looking at the examples in the book. Suggest that they cover up these examples. After they finish, they should compare their work with that in the book.

3 Assign Problems A and B and these exercises as written work. Tell pupils to write the numerals in computational form. When they have finished the assignment, provide answers so that they can verify their work. Give individual help where it is needed.

4 Assign these exercises as extra practice for those who need it.

187-189 Learning how

Expanded Notes for this lesson are on pages 294-295.

Objectives

The child learns how to subtract numbers that represent dollars and cents.

Vocabulary

There are no new words in this lesson.

Comments

Children learn that numbers that represent amounts of money are subtracted in the same way as any other numbers. They learn first to think of amounts of money in terms of cents. They find that the computation is handled in exactly the same way as the subtraction of two-figure and three-figure numbers that they have just studied. Next they see the same amounts of money written with the dollar sign and point. As in the lesson on addition of money, they are taught to keep the points in line and, finally, to write the dollar sign with the first amount and the answer. This form should be required of the child when he computes, but not necessarily when he writes his equation. Note that each answer below is given with the dollar sign and the point. The four-step teaching method is used.

Answers

Page 189:

(block 1)

A $.05	H $.08	N $1.38	T $.08
B $.74	I $.04	O $.18	U $1.04
C $.23	J $1.01	P $.52	V $.16
D $.16	K $2.08	Q $.58	W $2.47
E $.09	L $1.52	R $.27	X $2.79
F $.50	M $.66	S $.45	Y $2.75
G $.11			

(block 2)

A $.45	E $2.77	H $.94	K $.24
B $4.55	F $.17	I $.97	L $.23
C $3.28	G $.84	J $6.56	M $2.26
D $.44			

Learning how

Now you will learn how to subtract amounts of money, using numbers that mean dollars and cents.

see

Don had 54¢. He bought a puzzle that cost 26¢. How much money did he have left? 1

A

54¢ − 26¢ = ▩ 2 ← You must find this number.

Subtract just as you do with any numbers.

3
$$\begin{array}{r} 54 \\ 26 \\ \hline 28 \end{array}$$

When you subtract 26 from 54, your answer is 28. You know that 28 means 28¢.

B

When you subtract amounts of money, you write the numbers with points and dollar signs. 4

$.54 − $.26 = ▩ 5

Keep the points in a line, one under the other.

$$\begin{array}{r} \$.54 \\ \$.26 \\ \hline \$.28 \end{array}$$

Remember to put a point and dollar sign in the answer.

Don had $.28 left 6

$.54 − $.26 = $.28

think

Carol had $4.50. She bought Don a baseball cap that cost $1.79. Then she had how much money? 1

A

$4.50 − $1.79 = ▩ 3 ← You must find this number.

2

You can think of these numbers as meaning cents.

4
$$\begin{array}{r} 450 \\ 179 \\ \hline 271 \end{array}$$

← 271 means 271 cents or ▩ dollars and ▩ cents.

B

When you subtract amounts of money how should you write the numbers?

What must you remember about the points?

$$\begin{array}{r} \$4.50 \\ \$1.79 \\ \hline \$2.71 \end{array}$$

5

Remember to put a point in your answer.

Carol had ▩ left. 6

$4.50 − $1.79 = ▩

187

1 Ask pupils to read this problem. Call on someone to count (in Picture A) the money that Don had. Then have him count the amount of money that Don spent (26¢).

2 Have a pupil read this equation and relate the numerals to the money in the picture.

3 Have pupils look at the computational form and read the sentences beside it. Get them to relate the 28 to the proper coins in Picture A.

4 Ask pupils to read this statement. Be sure they understand that use of the dollar sign and point is the same as in addition.

5 Have them look at this equation and compare it with the one in A above. Ask if they mean the same.

6 Have a pupil count the money in Picture B and relate it to the remainder shown in the computation.

188

1 Have pupils read this problem.

2 Ask someone to count the money in this picture to see that it equals $4.50. Ask another pupil to point out and count the $1.79 that Carol spent.

3 Have a pupil read this equation and relate it to the picture.

4 Be sure pupils understand why $4.50 can be thought of as 450 cents and $1.79 as 179 cents. Help them see that the remainder, 271, can be thought of as $2.71.

5 Remind pupils of how amounts of money are written in addition. Tell them to examine this computation and the related text.

6 Ask a pupil to complete this statement and equation. Relate the amount shown in Picture B to the remainder obtained by computation.

try

A Tom had $1.20. He spent $1.05 for a baseball. How much money did he have left?
$1.20 − $1.05 = ▩

1

You do not need to write this dollar sign. →

2

$$\begin{array}{r} \$1.20 \\ \$1.05 \\ \hline \$\ .15 \end{array}$$

B Dick had 69¢ in his bank. He spent 25¢ for a package of peanut butter cookies. How much money was left in his bank?
$.69 − $.25 = ▩

1

2

$$\begin{array}{r} \$\ .69 \\ .25 \\ \hline \$\ .44 \end{array}$$

C $2.18 − $.72 = ▩

3

$$\begin{array}{r} \$2.18 \\ .72 \\ \hline \$1.46 \end{array}$$

D $4 − 56¢ = ▩

$$\begin{array}{r} \$4.00 \\ .56 \\ \hline \$3.44 \end{array}$$

E $8.42 − $5 = ▩

$$\begin{array}{r} \$8.42 \\ 5.00 \\ \hline \$3.42 \end{array}$$

do

Subtract

4

A 87¢ from 92¢
B $1.43 from $2.17
C 40¢ from 63¢
D 26¢ from 42¢
E $1.18 from $1.27
F 39¢ from 89¢
G $4.05 from $4.16
H $.07 from $.15
I 21¢ from 25¢
J $1.69 from $2.70
K 94¢ from $3.02
L 48¢ from $2.00

M 87¢ − 21¢ = ▩
N $2.01 − $.63 = ▩
O $1.15 − $.97 = ▩
P $4.16 − $3.64 = ▩
Q $.71 − 13¢ = ▩
R 69¢ − 42¢ = ▩
S 54¢ − 9¢ = ▩
T $1.63 − $1.55 = ▩
U $5.22 − $4.18 = ▩
V $1.48 − $1.32 = ▩
W $3.00 − 53¢ = ▩
X $7.28 − $4.49 = ▩
Y $3.71 − $.96 = ▩

5

A $1.05 − $.60 = ▩
B $6.50 − $1.95 = ▩
C $4.00 − 72¢ = ▩
D $.68 − $.24 = ▩
E $3.17 − $.40 = ▩
F 76¢ − 59¢ = ▩
G $6.00 − $5.16 = ▩
H $1.51 − 57¢ = ▩
I $3.06 − $2.09 = ▩
J $8.56 − $2.00 = ▩
K 38¢ − 14¢ = ▩
L $.73 − $.50 = ▩
M $4.05 − $1.79 = ▩

Now you can subtract amounts of money.

189

189

1 Pupils should read this problem and write the equation that states the problem situation. Then they should write the numbers in computational form and subtract.

2 Ask them to compare their work and answer with this example. Point out that they need to write the dollar sign only with the original amount and the answer.

3 Pupils are to copy the numbers on their papers and subtract. Then they are to compare their work with that shown here. If they get the correct answers, they may proceed to the practice.

4 Have pupils use Examples A to Y as written work. Tell them that in examples like K and L, they should use the dollar sign and point for both numbers in their written work. When everyone has finished, provide answers so that pupils can verify their work.

5 Assign these exercises as extra work for those who need it.

190 Checking up; Thinking straight

Expanded Notes are not considered necessary for these lessons.

Objectives

The child tests his ability to subtract. He learns a short cut to use when he has to change the hundreds before he can subtract the ones.

Vocabulary

There are no new words in these lessons.

Comments

The end-of-block tests on subtraction in the "Checking Up" section are not speed tests. Children should be given ample time to complete their work. If any children are deficient in the processes tested, take time to reteach them before proceeding with new work. Note that Test 1 deals with two-figure numbers, Test 2 with three-figure numbers, and Test 3 with money.

The "Thinking straight" exercise shows pupils a new way to subtract from a three-figure number when the middle, or tens' figure, is a zero. Such "zero difficulties" have traditionally been among the hard spots in subtraction. However, since this short cut is built on a knowledge of the number system that children already possess, it should be grasped easily and should provide more insight into the process of subtraction.

Answers

Test 1

A 23	C 76	E 46	G 8
B 35	D 36	F 20	H 23

Test 2

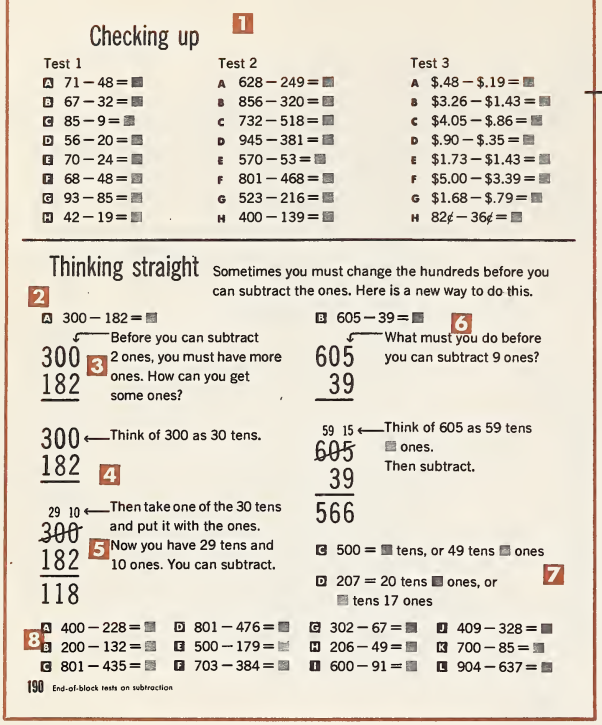
A 379	C 214	E 517	G 307
B 536	D 564	F 333	H 261

Test 3

A $.29	C $3.19	E $.30	G $.89
B $1.83	D $.55	F $1.61	H $.46

Thinking straight:

A 172	D 325	G 235	J 81
B 68	E 321	H 157	K 615
C 366	F 319	I 509	L 267



Checking up 1

Test 1
A 71 − 48 = ■
B 67 − 32 = ■
C 85 − 9 = ■
D 56 − 20 = ■
E 70 − 24 = ■
F 68 − 48 = ■
G 93 − 85 = ■
H 42 − 19 = ■

Test 2
A 628 − 249 = ■
B 856 − 320 = ■
C 732 − 518 = ■
D 945 − 381 = ■
E 570 − 53 = ■
F 801 − 468 = ■
G 523 − 216 = ■
H 400 − 139 = ■

Test 3
A $.48 − $.19 = ■
B $3.26 − $1.43 = ■
C $4.05 − $.86 = ■
D $.90 − $.35 = ■
E $1.73 − $1.43 = ■
F $5.00 − $3.39 = ■
G $1.68 − $.79 = ■
H 82¢ − 36¢ = ■

Thinking straight Sometimes you must change the hundreds before you can subtract the ones. Here is a new way to do this. 2

A 300 − 182 = ■

300 ← Before you can subtract
182 3 2 ones, you must have more ones. How can you get some ones?

300 ← Think of 300 as 30 tens.
182 4

29 10 ← Then take one of the 30 tens and put it with the ones.
~~300~~
182 5 Now you have 29 tens and 10 ones. You can subtract.
118

B 605 − 39 = ■ 6

605 ← What must you do before you can subtract 9 ones?
39

59 15 ← Think of 605 as 59 tens ■ ones. Then subtract.
~~605~~
39
566

C 500 = ■ tens, or 49 tens ■ ones

D 207 = 20 tens ■ ones, or ■ tens 17 ones 7

8
A 400 − 228 = ■
B 200 − 132 = ■
C 801 − 435 = ■
D 801 − 476 = ■
E 500 − 179 = ■
F 703 − 384 = ■
G 302 − 67 = ■
H 206 − 49 = ■
I 600 − 91 = ■
J 409 − 328 = ■
K 700 − 85 = ■
L 904 − 637 = ■

190 End-of-block tests on subtraction

190

1 Tell the children to compute and then write the answer beside its identifying letter.

2 Direct attention to the opening statement and to Example A. Tell pupils that they are going to learn a short cut that will make subtraction easier for them.

3 Discuss the situation of having no ones or tens, and let children show how to subtract in the usual way by borrowing 1 hundred, then 1 ten.

4 The children should have no trouble in thinking of 300 as 30 tens because of previous work they have had in regrouping.

5 Tell the children that now they should put one of the 30 tens in the ones' column so that they can subtract.

6 Handle Example B in the same way.

7 Be sure children can regroup the numbers in these exercises before proceeding with the exercises below.

8 Tell children that, if they need to, they may write the small numbers that show regrouping.

191 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving various types of problems.

Vocabulary

There are no new words in this lesson.

Comments

For each of these problems the children are to write an equation that describes the problem situation. After computing the answer, the equation should be rewritten with the missing number supplied. Remind the children that in some addition problems two equations are possible and either one is acceptable. There may be disagreement concerning the proper equation for Problem G. Some children may think that it should be 25+■ =52. Accept this equation, of course, if it is clear that the children think first of Jack's portion, and then think of Bob's portion as being the rest of the total 52 feet of fence.

Answers

In Problem O, there are three numbers to add. Accept any order given by the children.

A $5.08−$1.49=[$3.59]
B $.97+[$1.17]=$2.14
C 81−16=[65]
D 18+24=[42] or 24+18=[42]
E 39−18=[21]
F 32+29=[61] or 29+32=[61]
G 52−25=[27]
H $5.64+$6.10=[$11.74] or $6.10+$5.64=[$11.74]
I 43−15=[28]
J 213−147=[66]
K 72−56=[16]
L $2.16+$.55=[$2.71]
M 82−47=[35]
N 256−212=[44]
O $.95+$.37+$.15=[$1.47]
P 150+134=[284] or 134+150=[284]

Using arithmetic 1

A Bob had $5.08 in his bank. He took out $1.49 to pay for a new cap. How much money was left in his bank?

B Bill had $.97 in his bank. His father put in some more money. Then Bill emptied his bank and found he had $2.14. How much money had Bill's father put in Bill's bank?

C The children had 81 pieces of white chalk and 16 pieces of yellow chalk. They had how many fewer pieces of yellow chalk than of white chalk?

D At the candy store Carol bought 18 white candy mice and 24 chocolate mice. How many candy mice in all did Carol buy?

E Ann and Mary were making cookies. Mary cut out 18 cookies. Ann cut out 39 cookies. Ann cut out how many more cookies than Mary?

F June picked 32 flowers in a field. Betty picked 29 flowers in the field. The two girls picked how many flowers?

G Jack and Bob painted a garden fence that was 52 feet long. Jack painted 25 feet of the fence. How many feet did Bob paint?

H One week Jack earned $5.64, and Bob earned $6.10. How much money did the two boys earn that week?

I Nancy had 43 milk bottle caps. She gave 15 of them away. How many milk bottle caps did she keep?

J Bob had 213 baseball cards. Jack had 147 baseball cards. Jack had how many fewer baseball cards than Bob?

K There are 56 pieces in Betty's new puzzle. There are 72 pieces in Ann's puzzle. Ann's puzzle has how many more pieces than Betty's puzzle?

L Carol had $2.16 before she earned 55¢. How much money did she have then?

M Tom and Dick save coins of different kinds. Tom has 82 coins. Dick has 47 coins. Tom has how many more coins than Dick?

N Ellen read a storybook of 212 pages. Mary read a storybook of 256 pages. Ellen read how many fewer pages than Mary?

O Mary spent $.95 for a paintbox, $.37 for a small doll, and $.15 for a bag of peanuts. How much money in all did she spend?

P Don has 150 pictures of airplanes. Jack has 134 pictures of airplanes. Together they have how many pictures of airplanes?

2

191

1 Ask the children to write the equation that describes each problem situation, then to rewrite the figures in computational form and compute to get the answer.

2 When they have finished, let them compare their work with answers provided by you. It may be advisable to allow children to work together in groups with certain problems that were troublesome for some children. Discuss with the class any problems that caused much difficulty.

192 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to check addition by re-adding in the opposite direction. He learns to check subtraction by adding the remainder and the subtrahend.

Vocabulary

New words page192 correct, down*, check

Comments

Tell the children that the lesson on this page will show them how to make sure that they have added and subtracted correctly. When presenting the method for checking the correctness of addition, remind children of the lesson they had (page 130) in which they learned that the sum is the same regardless of the order of the numbers added. If they get different answers, they know there is a mistake somewhere in their work.

In presenting the method for checking subtraction, remind children of the lesson showing the relationship between addition and subtraction (page 132). There they learned that if a number that was added is thereafter taken away, the original number will remain (5+4=9; 9−4=5). Help them to see that, conversely, if a number that was taken away is added to the number that remains, the total is the number they had before the subtraction. Explain that this is why they can check subtraction by adding.

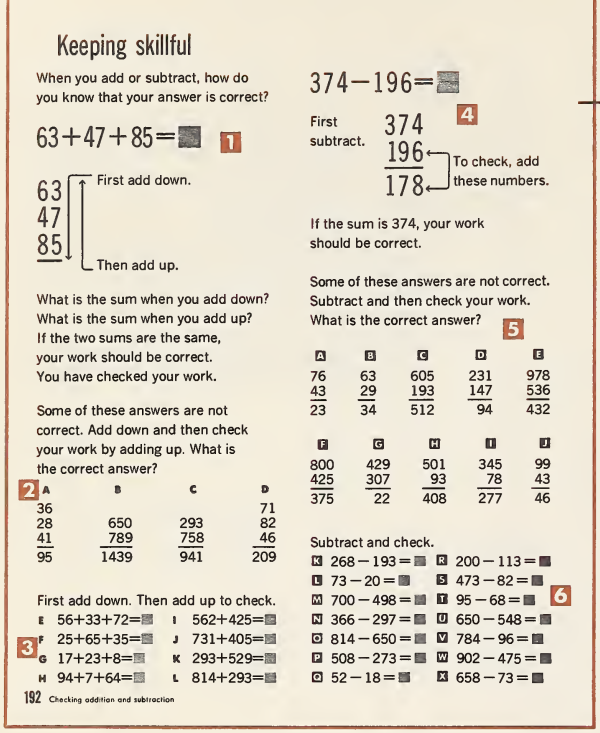
Answers

(addition)

A 105	D 199	G 48	J 1136
B Correct	E 161	H 165	K 822
C 1051	F 125	I 987	L 1107

(subtraction)

A 33	F Correct	K 75	P 235	U 102
B Correct	G 122	L 53	Q 34	V 688
C 412	H Correct	M 202	R 87	W 427
D 84	I 267	N 69	S 391	X 585
E 442	J 56	O 164	T 27	



Keeping skillful

When you add or subtract, how do you know that your answer is correct?

$63+47+85=\blacksquare$ **1**

63 — First add down.
47
85 — Then add up.

What is the sum when you add down?
What is the sum when you add up?
If the two sums are the same, your work should be correct.
You have checked your work.

Some of these answers are not correct. Add down and then check your work by adding up. What is the correct answer?

2

A	B	C	D
36			71
28	650	293	82
41	789	758	46
95	1439	941	209

First add down. Then add up to check.

3

E 56+33+72=■ I 562+425=■
F 25+65+35=■ J 731+405=■
G 17+23+8=■ K 293+529=■
H 94+7+64=■ L 814+293=■

$374-196=\blacksquare$ **4**

First subtract. 374
196 ← To check, add these numbers.
178 ←

If the sum is 374, your work should be correct.

Some of these answers are not correct. Subtract and then check your work. What is the correct answer?

5

A	B	C	D	E
76	63	605	231	978
43	29	193	147	536
23	34	512	94	432

F	G	H	I	J
800	429	501	345	99
425	307	93	78	43
375	22	408	277	46

Subtract and check.

K 268−193=■ R 200−113=■
L 73−20=■ S 473−82=■
M 700−498=■ T 95−68=■ **6**
N 366−297=■ U 650−548=■
O 814−650=■ V 784−96=■
P 508−273=■ W 902−475=■
Q 52−18=■ X 658−73=■

192 Checking addition and subtraction

192

1. Go through this exercise orally, calling on pupils to read the explanations and answer the questions.
2. Call on pupils to take turns adding these exercises on the board. When they have an answer that does not agree with the one in the book, they should add in the other direction and see if their answer still disagrees.
3. Tell pupils to copy the figures for each of these exercises in computational form, then to add both down and up.
4. Go through this exercise orally, calling on pupils to read the explanations and answer the questions.
5. Have pupils take turns doing each of these exercises on the board. When a child's answer does not agree with the one in the book, direct him to subtract and check again.
6. Have pupils copy the figures in computational form, subtract, check their answers, and correct any mistakes they have made.

193-196 Exploring problems

Expanded Notes for this lesson are on pages 295-296.

Objectives

The child learns to solve problems in which the original number of items is unknown, but in which the number of items added and the total number of items are known.

Vocabulary

New words page 193 records; page 194 begin; page 196 we*, went*, museum

Comments

The children meet the third type of additive problem—finding how many items there were to begin with when the number of items added and the number of items resulting are known. The other two additive problem types are: (1) the joining of two known groups and (2) the joining of an unknown group to a known group.

Two of these three additive types of situations are solved by subtraction. The "switch" in thinking which this necessitates is hard for children. Too often in the past they have been given little help in understanding such problems and have resorted to a method of trial and error, "cues," or outright memorization.

Solution of this third type of additive problem is taught in two stages of thinking. In the "See" step the child learns how to make the equation. He learns that the screen is used to indicate an unknown number that has been increased by a known number.

When he has made the equation, he must decide how to compute to find the number represented by the screen. In the "Compute" step he learns (by means of pictures and text) that he can find the number of items there were to begin with by subtracting the known increase from the known total.

Two problems of this type are completely worked out in the "See" and "Compute" steps on pages 193 to 195. Problems for independent practice appear on pages 195 and 196.

The "Keeping skillful" exercise, also on page 196, gives children practice in solving equations of this

new type and reviews addition and subtraction of two-figure and three-figure numbers.

Answers

Pages 195-196

Exploring problems:

The brackets in the answers below represent the screens in the equations the children are to make. The numbers within the brackets are the answers for the problems.

A [38]+18=56
B [$1.28]+$.35=$1.63
C [17]+24=41
D [8]+12=20
E [28]+24=52
F [$.82]+$.25=$1.07
G [15]+3=18
H [28]+4=32
I 102−83=[19]
J $1.26+[$.55]=$1.81
K $.96+[$.79]=$1.75
L 7+9=[16] or 9+7=[16]
M [12]+8=20
N [65]+150=215
O 17+[5]=22

Keeping skillful:

(block 1)

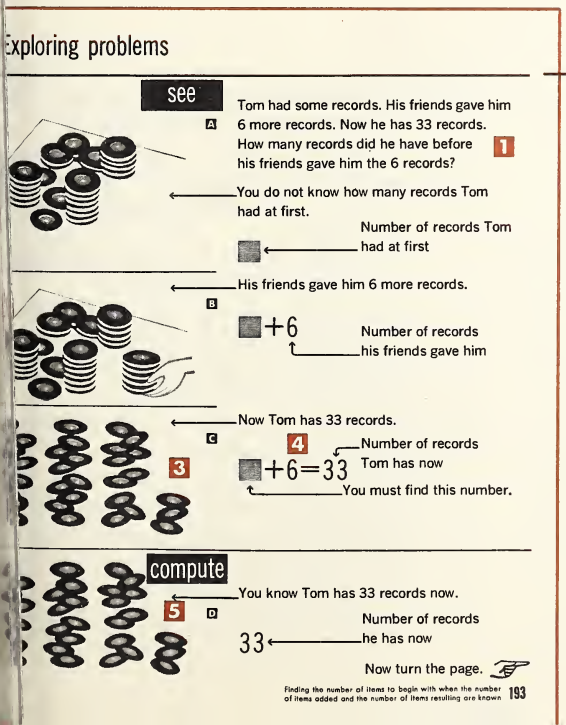
77	C 25	E 157	G 340	I 130
32	D 307	F 24	H 228	

(block 2)

A 23	C 31	E 1104	G 231	I 263
B 160	D 85	F 109	H 707	

(block 3)

A 45	C 80	E 335	G 195	I 75
B 46	D 343	F 386	H 149	


Exploring problems
see
A
Tom had some records. His friends gave him 6 more records. Now he has 33 records. How many records did he have before his friends gave him the 6 records?
1
You do not know how many records Tom had at first.
Number of records Tom had at first
His friends gave him 6 more records.
B
+6
Number of records his friends gave him
Now Tom has 33 records.
C
4
Number of records Tom has now
3
+6=33
You must find this number.
compute
5
D
You know Tom has 33 records now.
Number of records he has now
33
Now turn the page.
Finding the number of items to begin with when the number of items added and the number of items resulting are known
193

193

1 Have the children read this problem and see that we cannot tell for sure how many records Tom had. Direct attention to the screen and explain why it is written first.

2 Get the children to note that this picture shows the action of the problem—the bringing in of 6 more records. Explain how the plus sign and the 6 describe what is shown.

3 Point out that this picture shows the next piece of information the problem gives us. Explain that the records are arranged in three groups of 10 and 3 single records to help them recognize 33 records without counting.

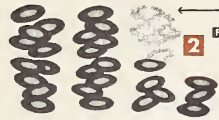
4 Have pupils explain how this equation describes the conditions of the problem.

5 Draw attention to the fact that this picture is the same as Picture C and that it shows one number we know—the number of records Tom had altogether. Explain to the children that now they are going to learn how to find the number that is missing in the equation.

Think of a group of records equal in number to the records Tom's friends gave him.

Number of records Tom's friends gave him

6



Imagine that this group of 6 records is gone.

33
6
Subtract 6 from 33.

33
6
27 ← The number left shows how many records Tom had to begin with. He had 27 records to begin with.

This number is 27. Tom had 27 records to begin with.

□ + 6 = 33

see

One day Bob picked up 24 shells and took them home. Then he counted all his shells and found he had 62 of them. How many shells did he have to begin with?

What does this stand for?
What does this number stand for?

□ + 24 = 62

What does this number stand for?

compute

How many shells does Bob have? Why do you imagine 24 of them are gone?

62
24
Should you add or subtract 24?
What will this show?

□ + 24 = 62 Bob had □ shells to begin with.

A After Ann made 18 nut cookies, she saw she had made 56 cookies in all. How many cookies did she make before she made the nut cookies?

□ + 18 = 56

THINK Imagine that 18 nut cookies are gone. Subtract 18 from 56.

B After Jim had put 35¢ in his bank, he found he had $1.63 in it. How much money was in his bank before he put in the 35¢?

□ + $.35 = $1.63

THINK Imagine that $.35 is gone. Subtract $.35 from $1.63.

C Nancy bought a box of 24 crayons. Then she had 41 crayons. How many did she have to begin with?

□ + 24 = 41 Subtract 24 from 41.

D Don got a box of 12 tops for his birthday. He said, "Now I have 20 tops." How many tops did he have before his birthday?

□ + 12 = 20 Subtract 12 from 20.

E Tom got 24 new baseball cards from his friends. He counted his cards and found he had 52 in all. Tom had how many baseball cards to begin with?

F After Mary earned 25¢ by helping her mother, she had $1.07. How much money did Mary have before she helped her mother?

G Dick's mother bought 3 quarts of milk on Saturday. She said, "I have bought 18 quarts of milk this week." How many quarts of milk did she buy before Saturday?

194

1 Explain that the ring around 6 records suggests that these records might be the ones Tom's friends gave him.

2 Draw attention to the dimmed-off group. Be sure the children understand that this is the group of 6 records that Tom received and which they are to think of as gone.

3 Have the children study this computation and relate the numbers to Picture F.

4 Direct attention to this equation and to the computation at the left. Children may check the answer by putting 27 in place of the screen and adding.

5 Get the children to note that Picture A shows two things: the shells Bob had to begin with and the 24 shells he picked up.

6 Have children relate this equation to the conditions of the problem and to Picture A.

195

1 Have children study this picture and answer the questions opposite the picture.

2 Relate the numerals and the screen to the conditions of the problem and to Picture B. Ask a pupil to find the number that belongs when the screen is.

3 Tell another pupil to complete the equation and the accompanying statement.

4 Tell pupils to read this problem and ask someone to explain how the equation describes the problem. Ask the pupils to subtract.

5 Adapt Note 4 to this problem.

6 Note that an equation is given and the children are told how to compute.

7 Children should now work independently. They should first write the equation with a screen (or square) for the unknown number. They then may indicate what computation needs to be done ("Subtract 24 from 52"). Finally, they should do the computation and rewrite the equation, supplying the missing number.

H Four boys went to the playground. Then there were 32 boys playing. How many boys were on the playground to begin with?

I One noon at school the children bought 102 bottles of chocolate milk and 83 bottles of white milk. They bought how many fewer bottles of white milk than of chocolate milk?

J Dick had $1.26. Then he earned some money by helping his father. Now he has $1.81. How much money did he earn helping his father?

K Tom is trying to save $1.75 to buy a baseball. He has saved $.96. How much more money does he need to buy the baseball?

L Carol took 7 apples to a picnic. The other children took 9 apples. How many apples did all the children take to the picnic?

M When Betty put 8 sandwiches on the picnic table, the children said, "Now we have 20 sandwiches." How many sandwiches did they have before Betty put down 8 sandwiches?

N Jim keeps all the different stamps he gets. After his sister gave him a package of 150 stamps, he found he had 215. He had how many stamps to begin with?

O Bill had 17 bird pictures. He got more bird pictures at the museum. Then he had 22 bird pictures. How many did he get at the museum?

In many of these problems you were finding out how many things there were to begin with. 1

Keeping skillful 2

4	5
A ■+15=92	A 28+■=51	A 82−37=■
B ■+73=105	B 76+84=■	B 98−52=■
C ■+35=60	C 59+■=90	C 105−25=■
D ■+264=571	D ■+148=233	D 479−136=■
E ■+58=215	E 865+239=■	E 582−247=■
F ■+9=33	F ■+91=200	F 815−429=■
G ■+360=700	G 75+■=306	G 737−542=■
H ■+296=524	H 409+298=■	H 608−459=■
I ■+177=307	I 537+■=800	I 400−325=■

16

196

1 Provide answers for the children to use after they have completed their work. If any problems have presented special difficulty, discuss them with the class.

2 Use the "Keeping skillful" exercises as a separate activity.

3 Tell the children that these equations were made for problems like the ones they have been solving. Have them write the exercises in computational form and find the answers.

4 Tell the children to decide for each example whether they should add or subtract to find the answer. They then should do the computation.

5 Have the children write the numerals in computational form and subtract.

97 Thinking straight; Keeping skillful

ponded Notes are not considered necessary for these lessons.

bjectives

ne child learns important generalizations about addi-on and subtraction involving zero.

ocabulary

here are no new words in these lessons.

mments

nderstanding the use of zero in addition and subtrac-on is part of understanding the number system.

Equations such as 5+0=5, 7−0=7, and 7−7=0 present an extension of the number system to include erations with the symbol 0. It is not feasible to dem-strate the truth of such equations by using objects. e children are, therefore, introduced to generaliza-ns about the use of zero by studying the form or pat-n of a sequence of statements. They can then see w equations involving zero "fit in" with similar equa-ns that involve basic facts without zeros.

This book teaches computation in such a way that the so-called "zero basic facts" are not explicitly involved. However, in tests the child is occasionally called on for zero basic facts, and this knowledge of zero helps to round out his general mathematical background. For these reasons this lesson on the use of zero has been included.

When this lesson on adding and subtracting zero with one-figure numbers has been completed, you might provide some work with larger numbers. For example, you might ask what happens when zero is added to 451, or when 430 is subtracted from 430.

Zeros should not give children much trouble. Actually, they have already worked with them. You might point this out by calling attention to earlier lessons in which the children worked with zeros—for example, page 155, Exercises F, I, and V in the first block of the DO step, and page 163, Examples A and B of the TRY step.

Thinking straight

1

5+5=10
5+4=9
5+3=8
5+2=7
5+1=6
5+0=5

A How is 5 + 4 different from 5 + 5?

B How is 5 + 3 different from 5 + 4?

C How is 5 + 0 different from 5 + 1?

2

4+4=8
3+4=
2+4=
1+4=
0+4=

D What is the answer when 0 is added to a number?

E How is 0 + 4 different from 1 + 4?

F What is the answer when a number is added to 0?

3

5−1=4
5−2=3
5−3=2
5−4=1
5−5=0

A How is 5 − 2 different from 5 − 1?

B How is 5 − 5 different from 5 − 4?

4

6−5=1
6−4=
6−3=
6−2=
6−1=
6−0=

C What is the answer when a number is subtracted from the same number?

D What is the answer when 0 is subtracted from a number?

5

A 2+0=
B 0+4=
C 4−0=
D 8−8=
E 9+0=
F 3−3=
G 5−0=
H 0+1=

I 0+8=
J 6−6=
K 7+0=
L 2−0=
M 0+3=
N 9−9=
O 5+0=
P 1−0=

A 9−0=
B 0+5=
C 2−2=
D 7−0=
E 1+0=
F 5−5=
G 0+7=
H 8−0=

I 1−1=
J 0+2=
K 3−0=
L 4+0=
M 8+0=
N 4−4=
O 6−0=
P 6+0=

Keeping skillful **6**

A 3×6=
B 4×4=
C 5×3=
D 2×6=
E 9×2=
F 3×4=

G 8×2=
H 4×3=
I 2×7=
J 6×3=
K 7×2=
L 3×5=

M 12÷6=
N 15÷=5
O 10÷=2
P 18÷3=
Q 14÷2=
R 16÷=4

S 12÷=3
T 16÷2=
U 9÷=3
V 14÷7=
W 18÷2=
X 15÷5=

197

1 Tell pupils to look at and comment on this series of six equations, then answer Questions A to D. To make sure that they all make the generalization asked for in Question D, ask "How much is 6 plus 0? 7 plus 0?" etc.

2 Have pupils examine these equations and answer Questions E and F. In F, emphasize what happens when *any* number is added to 0.

3 Have pupils examine and comment on these five equations. Let pupils answer Questions A to C. Check their grasp of Question C by asking "How much is 7 minus 7? 8 minus 8?" etc.

4 Tell them to examine and comment on this series of equations, then answer Question D.

5 Have pupils complete these equations either orally or in writing.

6 This section should be treated separately. Children may complete these equations either orally or in writing.

198-201 Moving forward

Expanded Notes for this lesson are on pages 296-298.

Objectives

The child learns the multiplication basic facts for the 20, 21, 24, and 25 groups.

Vocabulary

New words page 198 grocer*, food*, fruit; page 199 juice, soap, soup; page 200 tomato

Comments

The multiplication basic facts for 20, 21, 24, and 25 are presented pictorially in this lesson. Note the arrangement of these pictures. Movie A, with three scenes, shows completed action. In the first scene the four groups of five are shown in an informal arrangement. The next scene shows the almost finished rearrangement of four groups of five in straight rows. The final scene shows the completed arrangement, with rings around each group of 10 boxes so that the total of 20 boxes can be recognized easily. The other movies in this lesson follow the same general plan as Movie A except that only two scenes (the informal arrangement and the completed, formal arrangement) are shown. In each case, rings around groups of ten make it easy to recognize the total group without counting. Objects may be used by children who need more practice in recognizing groups.

Additional experiences with these basic facts can be provided by having the children make other problems using them. They can make their own drawings (circles, squares, dots, etc.) to illustrate the objects mentioned in their problems. Direct them to encircle groups of 10 to find the total number.

Answers

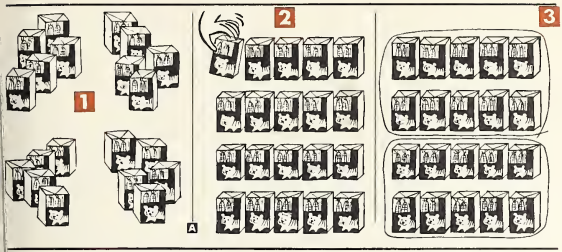
Keeping skillful:

(block 2)

A 109	E 698	I 158
B $5.10	F 51	J $3.08
C 51	G 54	K 112
D 25	H $1.25	L 683

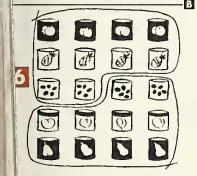
Moving forward

You will now learn how to multiply to make 20, 21, 24, and 25.



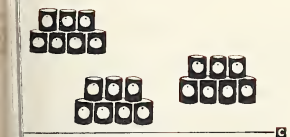
The grocer put a new kind of breakfast food on a shelf. He had 4 groups of boxes. There were 5 boxes in each group. How many boxes of breakfast food did he put on the shelf?

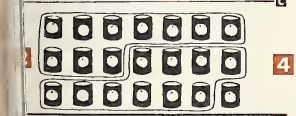
4 fives = ▩
5 multiplied by 4 = ▩
Multiply 5 by 4. 4 times 5 = ▩
4 × 5 = ▩



The grocer had five different kinds of fruit in cans. He had 4 cans of each kind. How many cans of fruit did he have in all?

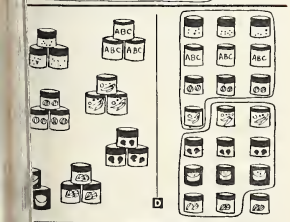
5 fours = ▩
4 multiplied by 5 = ▩
Multiply 4 by 5. 5 times 4 = ▩
5 × 4 = ▩





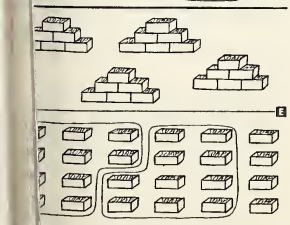
The grocer put some cans of fruit juice into 3 groups on a shelf in the store. There were 7 cans of fruit juice in each group. How many cans of fruit juice were there in all?

3 sevens = ▩
7 multiplied by 3 = ▩
Multiply 7 by 3. 3 times 7 = ▩
3 × 7 = ▩



There were 7 different kinds of soup in the store. There were 3 cans of each kind of soup. How many cans of soup were there in all?

7 threes = ▩
3 multiplied by 7 = ▩
Multiply 3 by 7. 7 times 3 = ▩
7 × 3 = ▩



The grocer had some cakes of soap. He put them in four piles. He put 6 cakes of soap in each pile. He had how many cakes of soap in all?

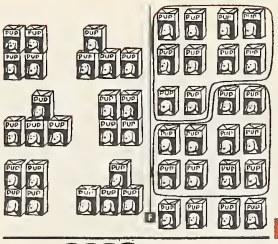
4 sixes = ▩
6 multiplied by 4 = ▩
Multiply 6 by 4. 4 times 6 = ▩
4 × 6 = ▩

198

1. Ask a pupil to tell how many groups of cereal boxes there are in the first scene of Movie A and how many boxes are in each group.
2. Ask another pupil what is happening in the second scene. Help the class to see that the boxes shown in the first scene are being put together.
3. Ask a pupil to tell how many boxes there are altogether in the third scene. Point out that the rings will help him see groups of 10.
4. Have a pupil read the text aloud, supplying the missing numbers.
5. Let a pupil read the problem for Movie B. Ask him to describe what he sees in the first scene.
6. Ask a pupil to tell what has happened to the equal groups in the second scene and what this suggests [multiplying].
7. Call on a pupil to read and complete the statements and equations.

199

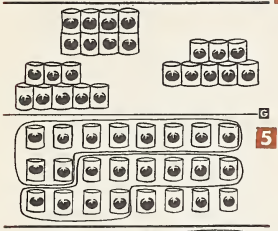
1. Have a pupil read the problem for Movie C and tell what he sees in the first scene.
2. Let another pupil tell what has happened to the cans in the second scene. Ask what is suggested when equal groups join to make a larger group. Let a child tell how many cans are in the large group after the 3 groups of 7 cans have been put together. Remind him that the rings around groups of 10 will help him see the number.
3. Call on a child to answer the question in the problem.
4. Ask another pupil to read and complete the statements and equation.
5. Use a similar procedure for this movie and problem.



A grocer is putting some boxes of dog food into 6 bags. He is putting 4 boxes into each bag. How many boxes of dog food in all is he putting into the bags? **3**

6 fours = ■
4 multiplied by 6 = ■
Multiply 4 by 6. 6 times 4 = ■ **4**
6 × 4 = ■

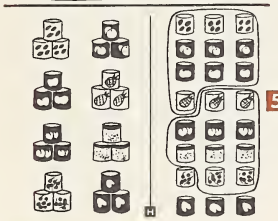
2



Some cans of tomato juice were in 3 piles on a shelf. There were 8 cans of tomato juice in each pile. How many cans of tomato juice were on the shelf?

5

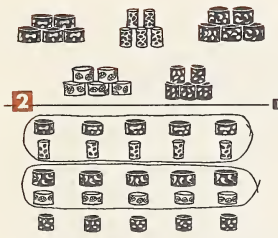
3 eights = ■
8 multiplied by 3 = ■
Multiply 8 by 3. 3 times 8 = ■
3 × 8 = ■



The grocer had 8 different kinds of fruit juice. He had 3 cans of each kind. He had how many cans of fruit juice in all?

5

8 threes = ■
3 multiplied by 8 = ■
Multiply 3 by 8. 8 times 3 = ■
8 × 3 = ■



There were 5 different kinds of nuts in cans on the shelf. There were 5 cans of each kind. How many cans of nuts were there in all? **1** **3**

5 fives = ■
4 5 multiplied by 5 = ■
Multiply 5 by 5. 5 times 5 = ■
5 × 5 = ■

5

A 3 × 8 = ■
B 5 × 4 = ■
C 7 × 3 = ■
D 4 × 6 = ■
E 5 × 5 = ■
F 8 × 3 = ■
G 4 × 5 = ■
H 6 × 4 = ■
I 3 × 7 = ■

6

A 6 times 4 = ■
B 3 times 8 = ■
C Multiply 5 by 5.
D 5 fours = ■
E Multiply 7 by 3.
F 4 times 5 = ■
G Multiply 3 by 8.
H 4 sixes = ■
I 7 threes = ■
J Multiply 6 by 4.
K 5 times 4 = ■
L 5 fives = ■
M Multiply 3 by 8.
N 3 times 8 = ■
O 4 fives = ■
P 3 sevens = ■
Q Multiply 4 by 6.
R 7 times 3 = ■

Now you should know how to multiply to make 20, 21, 24, and 25.

Keeping skillful

7

A 9 × 2 = ■
B 3 × 6 = ■
C 2 × 7 = ■
D 18 ÷ 6 = ■
E 14 ÷ 2 = ■
F 15 ÷ 5 = ■

8

A 218 − 109 = ■
B $4.87 + $.23 = ■
C 36 + ■ = 87
D 55 + ■ = 80
E 485 + 213 = ■
F 26 + ■ = 77
G 142 − 88 = ■
H $6.23 − $4.98 = ■
I 746 − 588 = ■
J $3.75 − $.67 = ■
K 547 + ■ = 659
L 402 + 281 = ■

200

1 Have a pupil read the problem for Movie F and tell what he sees in the first scene.
2 Let another pupil tell how the boxes of dog food have been rearranged in the second scene. Ask what is suggested when equal groups join to form a larger group. Ask how many boxes of dog food there are altogether in the second scene. Call attention to the rings that help the pupil see the groups of 10.
3 Ask a pupil to answer the question in the problem.
4 Have another pupil read and complete the statements and equation.
5 Use the same procedure for this movie and problem.

201

1 Let the class read the problem silently.
2 Ask a pupil to explain Movie I, telling wh what he sees in the first scene and the re grouping in the second scene suggest multi plication.
3 Call on another pupil to read and answer th question in the problem.
4 Ask a child to read the statements and equa tion, saying the missing numbers.
5 For the first block of exercises let the childre read the equations aloud, saying the missin numbers. Then, if you wish, have them writ the completed equations.
6 Call on children to complete these statemen orally. Then you may ask them to write th complete equation for each.
7 Use this block of exercises first for oral wor then as written work.
8 Use these exercises as written work.

202-205 Moving forward

Expanded Notes for this lesson are on pages 298-299.

Objectives

The child learns the division basic facts for the 20, 21, 24, and 25 groups.

Vocabulary

There are no new words in this lesson.

Comments

The division basic facts for 20, 21, 24, and 25 are presented in both pictorial and symbol forms. Movie A on page 202, for example, presents the basic fact $20 \div 5 = 4$. The first scene shows a group of 20 bars of soap. The bars are arranged in two horizontal rows of 10 to facilitate recognition of the quantity as 20. The second scene shows the same arrangement of 20 bars of soap as 4 groups of 5 bars. Each group of 5 bars is shown by a ring. A similar procedure is used to present all the division basic facts taught in this block of work. Equality of groups should be stressed so that the child will not confuse divisive actions with subtractive actions.

Additional experiences with these basic facts can be provided by having the children make other problems using them. They can make their own drawings (circles, squares, dots, etc.). Direct them to arrange the objects in their pictures in rows of 10 and then to encircle the number of objects that are in the equal groups. Be sure the children make up problems that require the finding of the number of equal groups, not the size of the equal groups.

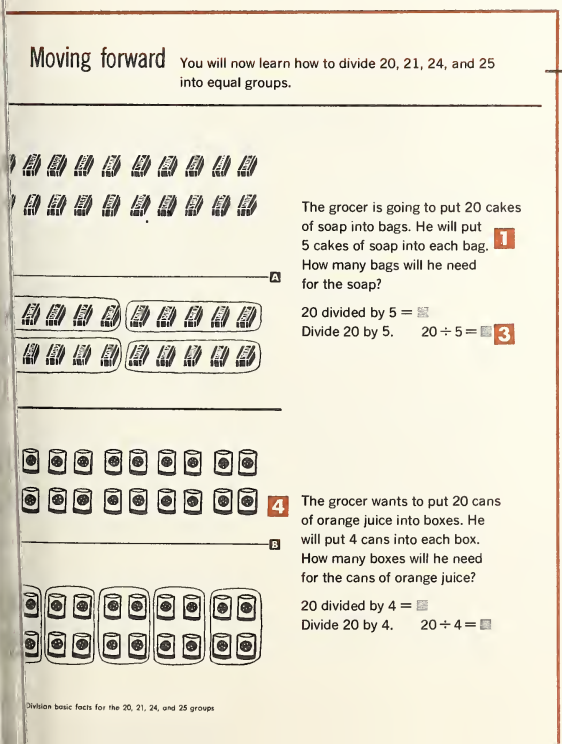
In the "Keeping skillful" section, the child finds review exercises in mixed basic facts and addition and subtraction of two-figure and three-figure numbers.

Answers

Keeping skillful:

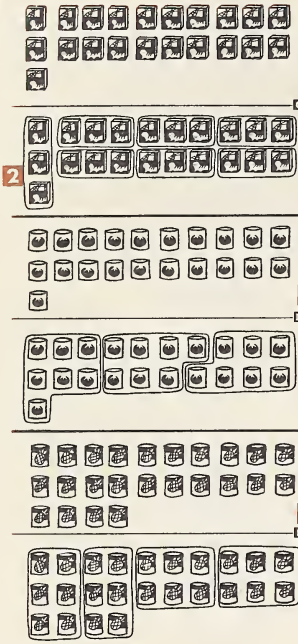
(block 3)

A 86	C 72	E 25	G 79
B 803	D 279	F 155	


Moving forward
You will now learn how to divide 20, 21, 24, and 25 into equal groups.
The grocer is going to put 20 cakes of soap into bags. He will put 5 cakes of soap into each bag. How many bags will he need for the soap?
1
A
20 divided by 5 = ■
Divide 20 by 5.
20 ÷ 5 = ■
3
4
The grocer wants to put 20 cans of orange juice into boxes. He will put 4 cans into each box. How many boxes will he need for the cans of orange juice?
B
20 divided by 4 = ■
Divide 20 by 4.
20 ÷ 4 = ■
Division basic facts for the 20, 21, 24, and 25 groups

202

1. Have a pupil read the problem and describe what he sees in the first scene of Movie A.
2. Tell pupils that the rings show how they can imagine the separating of the bars into groups. Then ask how many bars are in each ringed group. Ask how many groups of 5 the 20 bars of soap will make. Be sure they understand that this separating into equal groups suggests division. Have pupils read and answer the question in the problem.
3. Let a child read and complete these expressions. Get him to explain how the second scene illustrates each.
4. Use the same procedure for this movie and its text.



The grocer sold 21 boxes of breakfast food. He sold 3 boxes of breakfast food to each child in the store. How many children were in the store? **1**

21 divided by 3 = ■
Divide 21 by 3. 21 ÷ 3 = ■

2

The grocer is going to put 21 cans of soup into boxes. He will put 7 cans into each box. How many boxes does he need? **3**

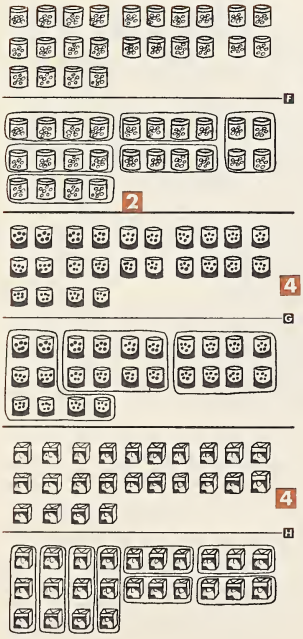
21 divided by 7 = ■
Divide 21 by 7 21 ÷ 7 = ■

The grocer is going to put 24 cans of fruit into groups. He will put 6 cans of fruit into each group. How many groups will he have? **3**

24 divided by 6 = ■
Divide 24 by 6. 24 ÷ 6 = ■

203

1. Ask a child to read the text for Movie C without trying to supply any of the answers. Then have him tell what he sees in the first scene. Be sure the children understand that the boxes are arranged in two horizontal rows of 10 and one single box so they can recognize 21 without counting.
2. Have another pupil explain how the second scene illustrates the action of the problem by telling how many boxes are in each ringed group and how many groups of 3 there are. Be sure the pupils understand that division is suggested when a large group is separated into equal smaller groups. Call on someone to answer the question and supply the missing numbers in the statements and equation.
3. Follow a similar procedure for this movie and its text.



The grocer put 24 cans of nuts into bags. He put 4 cans into each bag. How many bags did he use? **1**

24 divided by 4 = ■
Divide 24 by 4. 24 ÷ 4 = ■

2 **3**

The grocer will put 24 cans of fruit juice into bags. He will put 8 cans into each bag. How many bags will he use for the fruit juice? **4**

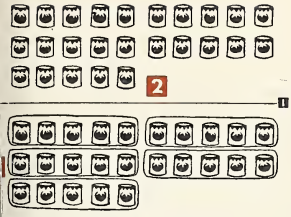
24 divided by 8 = ■
Divide 24 by 8. 24 ÷ 8 = ■

The grocer put 24 boxes of dog food into groups. He put 3 boxes into each group. How many groups did he have? **4**

24 divided by 3 = ■
Divide 24 by 3. 24 ÷ 3 = ■

204

1. Let a child read the text aloud without supplying the answer. Tell him to describe what he sees in the first scene.
2. Ask a pupil to explain how the second scene illustrates the problem.
3. Call on someone to answer the question and supply the missing numbers in the statements and equation.
4. Use a similar procedure for this movie and its text.



The grocer is going to put 25 cans of tomato juice into boxes. He will put 5 cans into each box. How many boxes does he need?

25 divided by 5 = ▒
Divide 25 by 5. 25 ÷ 5 = ▒

A 24 ÷ 8 = ▒	A Divide 21 by 3.	J 24 divided by 8 = ▒
B 20 ÷ 5 = ▒	B 25 divided by 5 = ▒	K Divide 20 by 4.
C 21 ÷ 3 = ▒	C 20 divided by 4 = ▒	L 24 divided by 3 = ▒
D 24 ÷ 6 = ▒	D Divide 24 by 8.	M Divide 21 by 7.
E 20 ÷ 4 = ▒	E 24 divided by 6 = ▒	N 20 divided by 5 = ▒
F 24 ÷ 3 = ▒	F 21 divided by 7 = ▒	O Divide 24 by 6.
G 21 ÷ 7 = ▒	G Divide 25 by 5.	P Divide 24 by 3.
H 25 ÷ 5 = ▒	H Divide 24 by 4.	Q 21 divided by 3 = ▒
I 24 ÷ 4 = ▒	I Divide 20 by 5.	R 24 divided by 4 = ▒

Now you should know how to divide 20, 21, 24, and 25 into equal groups.

Keeping skillful

A 5 × 2 = ▒	H 24 ÷ 8 = ▒	A 24 ÷ ▒ = 6	A 47 + 39 = ▒
B 12 ÷ 6 = ▒	I 4 × 3 = ▒	B 18 ÷ ▒ = 9	B 321 + 482 = ▒
C 25 ÷ 5 = ▒	J 3 × 8 = ▒	C 16 ÷ ▒ = 4	C 87 + ▒ = 159
D 3 × 5 = ▒	K 21 ÷ 7 = ▒	D 21 ÷ ▒ = 3	D 563 − 284 = ▒
E 6 × 3 = ▒	L 4 × 4 = ▒	E 20 ÷ ▒ = 5	E 67 − 42 = ▒
F 5 × 4 = ▒	M 20 ÷ 5 = ▒	F 15 ÷ ▒ = 3	F 98 + 57 = ▒
G 14 ÷ 2 = ▒	N 2 × 9 = ▒	G 25 ÷ ▒ = 5	G 821 + ▒ = 900

205

205

1 Ask the class to read the problem and then look at Movie I.

2 Ask a pupil to tell what he sees in the first scene.

3 Have a pupil explain how the second scene illustrates the conditions of the problem by pointing out how many cans are in each group and how many groups of 5 he can find in the 25.

4 Ask a pupil to read the statements and equation, saying the missing numbers.

5 The pupils may first read aloud and then write these equations, which include all the new facts.

6 Let the children write an equation to state each of the basic facts called for in these exercises.

7 The children may write the complete equations or the answers only for these exercises.

8 Direct the children to copy these in computational form and find the answers.

206 Checking up; Side trip

panded Notes for these lessons are on pages 299-300.

jectives

he child tests his knowledge of the multiplication and vision basic facts for the 20, 21, 24, and 25 groups and introduced to ordinal words as a system.

cabulary

ew words page 206 twelfth

nments

e end-of-block tests called "Checking up" are power ts, not speed tests. Give the children as much time they need. Test 1 covers the new multiplication basic ts. Test 2 covers the new division basic facts. Test 3 vers the new division basic facts in equations that resent situations in which the size of the equal groups to be found (see pages 134-138). Test 4 is a mixed on the new basic facts.

he ordinal words in the "Side trip" should be taught a system, not as a rote memory exercise. Observe that ordinal words are given in sequence, from *first* to *fifteenth*, corresponding to the numerals on the row of chairs in the picture. The children should learn to associate "1" with "first," "4" with "fourth," and so on. They should be able to complete this list through *nineteenth* on their own.

The second column of ordinal words shows how they are built up within the decades and over 100. Children should be permitted to extend this list as far as their interest carries them. Some of the abler children may wish to do this in writing.

Checking up

Test 1 1

A 4×5=▢
B 6×4=▢
C 3×7=▢
D 8×3=▢
E 5×5=▢
F 7×3=▢
G 5×4=▢
H 3×8=▢
I 4×6=▢

Test 2 1

A 20÷4=▢
B 24÷6=▢
C 21÷7=▢
D 20÷5=▢
E 24÷8=▢
F 21÷3=▢
G 24÷3=▢
H 25÷5=▢
I 24÷4=▢

Test 3 2

A 24÷▢=6
B 21÷▢=3
C 24÷▢=4
D 20÷▢=5
E 24÷▢=8
F 20÷▢=4
G 21÷▢=7
H 24÷▢=3
I 25÷▢=5

Test 4 3

A 4×5=▢
B 24÷8=▢
C 21÷▢=7
D 8×3=▢
E 20÷▢=4
F 4×6=▢
G 24÷▢=6
H 7×3=▢
I 21÷3=▢

Side trip

4

					5		6
A	1	first	A	20	twentieth	A	37
B	2	second	B	21	twenty-first	B	104
C	3	third	C	22	twenty-second	C	99
D	4	fourth	D	30	thirtieth	D	234
E	5	fifth	E	31	thirty-first	E	395
F	6	sixth	F	40	fortieth	F	62
G	7	seventh	G	43	forty-third	G	181
H	8	eighth	H	70	seventieth	H	46
I	9	ninth	I	79	seventy-ninth	I	53
J	10	tenth	J	100	one hundredth	J	170
K	11	eleventh	K	101	one hundred first	K	201
L	12	twelfth	L	111	one hundred eleventh	L	400
M	13	thirteenth	M	121	one hundred twenty-first	M	85
N	14	fourteenth	N	150	one hundred fiftieth	N	38
O	15	fifteenth	O	162	one hundred sixty-second	O	72

206 End-of-block tests on multiplication and division basic facts for 20, 21, 24, and 25. Ordinals as a system

206

1. Have the children write each equation, supplying the missing number.
2. Tell the children that for each of these exercises they are to write a statement showing what they need to do to find the missing number. [For example, for Equation A they should write "Divide 24 by 6."] They then should write the equation, supplying the missing number.
3. Each of these equations is to be written with the missing number supplied.
4. Explain why we use ordinal words [to indicate position]. Relate the words in this column to the numerals on the chairs. Give each child an object to use as a marker. Say ordinal words (up to *fifteenth*) in random order and have the children place their markers on the proper chair as you say the word.
5. Get the children to extend this list.
6. Call on the children to give the ordinal words for each of these numerals.

207-208 Checking up

Exponded Notes are not considered necessary for this lesson.

Objectives

The child tests his ability to solve problems, to add, and to subtract. He also tests his knowledge of the multiplication and division basic facts.

Vocabulary

There are no new words in this lesson.

Comments

The problem-solving test includes all the types of problems taught thus far. No computation outside the basic facts is included in this set of problems. Computational difficulties are thus kept at a minimum, and children are free to concentrate on making the proper equations. In some addition problems two equations are possible, and either is acceptable. Remind the children to think about each problem carefully to "see" what is happening before they write the equation. Results on this achievement test will give you a good overall picture of how well children understand problem solving and the making of equations to fit problems.

Tests 2 to 8 should not be treated as speed tests. Give the children all the time they need to do the work on each test.

Reteaching guide

The pages listed below tell you where to find reteaching materials if you need them.

Test 1

Problem	Page	Problem	Page	Problem	Page
A	37-38	G	39-41	M	75-78
B	134-138	H	37-38	N	39-41
C	72-74	I	37-38	O	72-74
D	193-196	J	193-196	P	134-13
E	39-41	K	75-78		
F	37-38	L	39-41		

Test 2

Pages 156-159, 160-163, 164-169

Test 3

Pages 176-179, 180-186

Exercise	Test 4	Test 5	Test 6	Test 7	Test 8
A	98-99	33	134-138	170-172	75-78
B	120-121	202-205	116-117	170-172	180-186
C	28	107	115	187-189	160-163
D	32	117	117	170-172	180-186
E	120-121	100-101	193-196	187-189	193-196
F	198-201	112	105-106	187-189	75-78
G	112	122-123	75-78	170-172	164-169
H	116-117	24	134-138	187-189	193-196
I	198-201	100-101	193-196	170-172	176-179
J	106-107	122-123	32	187-189	75-78
K			80-82	170-172	180-186

Answers

Test 1

A $12-8=[4]$
B $12\div[4]=3$
C $10¢-6¢=[4¢]$
D $[5]+9=14$
E $5\times5¢=[25¢]$
F $7+9=[16]$ or $9+7=[16]$
G $12\div6=[2]$
H $8¢+5¢=[13¢]$ or $5¢+8¢=[13¢]$
I $18-9=[9]$
J $[7]+4=11$
K $9¢+[6¢]=15¢$
L $4\times6¢=[24¢]$
M $6+[4]=10$
N $15¢\div3¢=[5]$
O $16-7=[9]$
P $25¢\div[5¢]=5$

Test 2

A 20	D 60	G 142	
B 21	E 84	H 595	
C 27	F 129	I 850	

Test 3

A 38	D 18	G 49	J 60
B 7	E 247	H 366	
C 26	F 229	I 340	

Test 7

A $1.60	E $.34	I $9.00	
B $4.43	F $1.77	J $.21	
C $.14	G $2.65	K $5.84	
D $1.02	H $4.48		

Test 8

A 26	D 316	G 171	J 40
B 9	E 22	H 68	K 99
C 147	F 58	I 15	

Checking up

Test 1

1 Twelve boys and girls went to a museum. There were 8 boys in the group. How many girls were there?

2 The 12 children went to the museum in 3 cars. The same number of children went in each car. How many children went in each car?

3 On the way, Dick bought a large candy bar that cost 10¢. Nancy bought a smaller one for 6¢. Dick's candy bar cost how much more than Nancy's?

4 Before Bill went to the museum, he had some pennies. Then his father gave him 9 pennies. Bill said, "Now I have 14 pennies." How many pennies did Bill have to begin with?

5 Five of the children went to a show at the museum. Each child paid 5¢ to see the show. How much did the 5 children pay altogether?

6 At the museum the children counted 7 animals in one room and 8 animals in another room. How many animals were there in the two rooms?

G At lunch there was room for 6 children at one table. How many tables did the 12 children need?

H Carol spent 8¢ for milk and 5¢ for an apple at the museum. How much did she spend in all for the milk and the apple?

I There were 18 different kinds of animal pictures in the museum store. 9 kinds were small, and the others were large. How many kinds of pictures were large?

J Ann bought some animal pictures when she came into the museum. She bought 4 more pictures before she left. Then she had 11 pictures. How many pictures did Ann buy when she came in?

K Tom saw an animal book he wanted to buy. It cost 15¢. Tom had 9¢. How much more money did he need to buy the book?

L Jim bought 4 animal pictures at the museum. He paid 6¢ apiece for them. How much did Jim pay in all for the four pictures?

Now turn the page.

207

1 Tell children to read each problem (A to P) and write an equation for it, using a screen (or square) to indicate the missing number. Then have them rewrite each equation, supplying the missing number.

M Mary bought 6 animal pictures. Her mother bought some more for her. Then Mary had 10 animal pictures. How many animal pictures did Mary's mother buy for her?

N June had fifteen cents to spend for pictures. They cost 3¢ apiece. How many pictures could she buy?

O Bob saw 16 large shells and 7 small shells on a table. There were how many fewer small shells than large shells on the table?

P Five of the boys bought a book about animals. The book cost 25¢. They shared the cost equally. How much did each boy pay? 1

Test 2 2

Add

A 9, 4, 7
B 6, 7, 5, 3
C 4, 8, 6, 9
D 43, 17
E 59, 25
F 29, 17, 83
G 48, 75, 19
H 427, 168
I 220, 630

Test 3 2

A 67 − 29 = ■
B 94 − 87 = ■
C 40 − 14 = ■
D 80 − 62 = ■
E 543 − 296 = ■
F 911 − 682 = ■
G 307 − 258 = ■
H 502 − 136 = ■
I 793 − 453 = ■
J 820 − 760 = ■

Test 4 3

A 4 × 3 = ■
B 9 × 2 = ■
C 3 × 3 = ■
D 5 × 2 = ■
E 3 × 6 = ■
F 5 × 4 = ■
G 3 × 5 = ■
H 8 × 2 = ■
I 6 × 4 = ■
J 2 × 7 = ■

Test 5 4

A 10 ÷ 5 = ■
B 24 ÷ 6 = ■
C 14 ÷ 7 = ■
D 16 ÷ 4 = ■
E 12 ÷ 6 = ■
F 15 ÷ 3 = ■
G 18 ÷ 6 = ■
H 8 ÷ 4 = ■
I 12 ÷ 3 = ■
J 18 ÷ 3 = ■

Test 6 5

A 10 ÷ ■ = 2
B 4 × 4 = ■
C 9 + 7 = ■
D 16 ÷ 8 = ■
E ■ + 8 = 15
F 14 − 9 = ■
G 9 + ■ = 13
H 18 ÷ ■ = 9
I ■ + 6 = 11
J 5 × 2 = ■
K 17 − 8 = ■

Test 7 6

A $.82 + $.78 = ■
B $1.97 + $2.46 = ■
C $.92 − $.78 = ■
D $.13 + $.89 = ■
E $3.40 − $3.06 = ■
F $6.50 − $4.73 = ■
G $2.05 + $.60 = ■
H $5.14 − $.66 = ■
I $1.42 + $7.58 = ■
J $4.01 − $3.80 = ■
K $.96 + $4.88 = ■

Test 8 7

A 28 + ■ = 54
B 168 − 159 = ■
C 85 + 62 = ■
D 402 − 86 = ■
E ■ + 54 = 76
F 42 + ■ = 100
G 67 + 104 = ■
H ■ + 13 = 81
I 73 − 58 = ■
J 15 + ■ = 55
K 177 − 78 = ■ 1

208

208

1 Use the "Reteaching Guide" on pages 164 and 165 to help you plan remedial work where it is needed.

2 Pupils are to write the numbers in computational form and find the answers.

3 Test 4 is a check up on ten selected multiplication basic facts. Pupils should write the equations with the answers.

4 Test 5 is a check up on ten selected division basic facts. Pupils should write the equations with the answers.

5 Test 6 is an exercise in solving equations that include division, multiplication, addition, and subtraction basic facts. Pupils should write the equations with the answers.

6 Test 7 is a test on the addition and subtraction of numbers that represent money.

7 Test 8 covers all the types of additive and subtractive equations taught so far.

209-210 Moving forward

Exponded Notes for this lesson are on pages 300-301.

Objectives

The child learns that there can be remainders in division.

Vocabulary

New words page 209 remainder

Comments

Up to this point the children have encountered two divisive situations: finding the number of equal groups and finding the size of the equal groups. In neither case have they met remainders. However, some knowledge of remainders is necessary to round out the child's mathematical background and to enable him to react appropriately in certain situations he may encounter.

This lesson introduces division with remainders within the range of the basic facts taught thus far. (No dividend exceeding 26 is used at this point, and with 2 as a divisor the largest dividend used is 19.) The situations used are confined to those where the number of equal groups is to be found, as was done when teaching the basic facts.

Many children will benefit if they are allowed to use objects that they can divide into equal groups and observe the remainders. If this is done, be careful not to go beyond the limits mentioned in the preceding paragraph.

There will be no extension of the work on division with remainders until Grade 4.

Answers

(block 1)

A 3 and 2 rm.
B 5 and 1 rm.
C 16, 20, 24, 8
D 15, 21, 12, 24, 18

(block 2)

A 3 and 3 rm.
B 3 and 4 rm.
C 5 and 1 rm.
D 2 and 2 rm.
E 4 and 4 rm.
F 2 and 4 rm.
G 2 and 4 rm.
H 4 and 2 rm.
I 2 and 1 rm.
J 2 and 1 rm.
K 3 and 1 rm.
L 2 and 1 rm.
M 2 and 4 rm
N 2 and 6 rm
O 2 and 2 rm
P 6 and 2 rm
Q 6 and 1 rm
R 7 and 1 rm

Moving forward

In this lesson you will learn something new about dividing numbers.

A At the museum a man put 16 butterflies on cards. He put 5 on each card. How many cards did he need? Did he have any butterflies left over? **1**

The 1 butterfly left over is the remainder.

16 ÷ 5 = 3 and 1 remainder **2**

B If the man had put 3 butterflies on each card, how many cards would he have needed? Would he have had any butterflies left over? **3**

16 ÷ 3 = 5 and ■ remainder

C If he had put 7 butterflies on each card, how many cards would he have needed? Would he have had any butterflies left over? **3**

16 ÷ 7 = ■ and ■ remainder

D If he had put 6 butterflies on each card, how many cards would he have needed? Would he have had any butterflies left over? **3**

16 ÷ 6 = ■ and ■ remainder

Now turn the page.

E If you had 25 butterflies and wanted to put 9 butterflies on each card, how many cards would you need? Would any butterflies be left over? **1**

25 ÷ 9 = ■ and ■ remainder

F If you had 21 butterflies and wanted to put 8 butterflies on each card, how many cards would you need? Would any butterflies be left over? **1**

21 ÷ 8 = ■ and ■ remainder

A Bird pictures cost 6¢ apiece. Nancy wanted to buy some. She had 20¢. How many of the pictures could she have bought? Would she have had any money left over?

20 ÷ 6 = ■ and ■ remainder

B Animal stamps cost 4¢ apiece. Jim had 21¢ to spend for stamps. How many stamps could he have bought? Would he have had any money left over?

21 ÷ 4 = ■ and ■ remainder

C Which of these numbers can be divided by 4 without a remainder?

16 10 22 20 24 15 8

D Which of these numbers can be divided by 3 without a remainder?

15 21 11 12 24 18 16

A 15 ÷ 4 = 3 and ■ remainder
B 25 ÷ 7 = 3 and ■ remainder **4**
C 16 ÷ 3 = ■ and ■ remainder
D 12 ÷ 5 = ■ and ■ remainder
E 24 ÷ 5 = ■ and ■ remainder
F 20 ÷ 8 = ■ and ■ remainder
G 14 ÷ 5 = ■ and ■ remainder
H 18 ÷ 4 = ■ and ■ remainder
I 15 ÷ 7 = ■ and ■ remainder
J 9 ÷ 4 = ■ and ■ remainder
K 16 ÷ 5 = ■ and ■ remainder
L 17 ÷ 8 = ■ and ■ remainder
M 18 ÷ 7 = ■ and ■ remainder
N 24 ÷ 9 = ■ and ■ remainder
O 8 ÷ 3 = ■ and ■ remainder
P 20 ÷ 3 = ■ and ■ remainder
Q 25 ÷ 4 = ■ and ■ remainder
R 15 ÷ 2 = ■ and ■ remainder

Sometimes when you divide to find how many equal groups there are, you will have a remainder.

209

1. Have the problem read. Direct attention to the picture and relate the numerals in the problem to the picture. Be sure the pupils understand that the butterflies within a ring are those that the man put on one card.
2. Discuss the word *remainder*. Emphasize that it means the number left over when the total group has been divided as completely as possible into smaller groups of the size wanted in the problem.
3. Use similar procedures with this problem and its picture. Let the children use the picture to find the number that belongs where the screen is. Get the children to observe that the remainder is always smaller than the divisor.

210

1. Have the children read the problem and relate the numbers and action to the picture.
2. Ask a child to supply the missing numbers. Tell the children that they may use objects on their desks, if they need to, to show the number of equal groups and the number left over.
3. Previous experience with division should make it simple for the child to find the numbers that can be divided without remainders. Have the children tell orally or write on paper just the numbers that can be divided without remainders.
4. Children should observe by now that when a number cannot be divided without a remainder they should use the next smaller number that can be divided without a remainder. Permit them to use objects on their desks, if they need to. You may use these exercises orally first and then as written work, if you wish.

211 Using arithmetic

Exponded Notes ore not considered necessary for this lesson.

Objectives

The child solves problems including all the types of problem situations studied thus far.

Vocabulary

There are no new words in this lesson.

Comments

Children should attack these verbal problems by writing equations for them. They should be able to work independently on these problems, first writing the equation that tells the story of the problem, then computing, and then rewriting the equation with the missing number supplied.

The work children do on sets of problems such as these reveals the extent of their understanding of the arithmetic concepts they have been studying.

Answers

A $8¢+[7¢]=15¢$

B $\$.40-\$.25=[\$.15]$

C $20\div[5]=4$

D $15¢\div[5¢]=3$

E $\$.27+\$.58=[\$.85]$ or $\$.58+\$.27=[\$.85]$

F $25¢\div5¢=[5]$

G $2\times4=[8]$

H $\$.50-\$.38=[\$.12]$

I $[\$.75]+\$.25=\$1.00$

J $12\div[4]=3$

K $242-78=[164]$

L $8+2+5=[15]$

M $\$.25-\$.15=[\$.10]$

N $2+3+5=[10]$

O $\$1.25-\$.68=[\$.57]$

Using arithmetic 1

A At the circus Bob saw a man selling balloons for 15¢ apiece. Bob had 8¢. How much more money did he need to buy a balloon?

B Don wanted to buy an airplane on a stick that cost $.25. He had $.40. How much money would he have left if he bought an airplane?

C Bob bought a box of candy that had 20 pieces in it. He shared the candy equally with 3 other boys. How many pieces did each of the 4 boys get?

D Bill had fifteen cents. He bought 3 candy bars of the same kind. They cost how many cents apiece?

E Ellen bought a doll that cost $.27, and Betty bought a doll that cost $.58. How much money did the girls pay for the two dolls?

F Nancy spent 25¢. She bought some candy bars that cost 5¢ apiece. How many candy bars did she buy?

G Jim bought 2 boxes of candy bars. There were 4 candy bars in each box. How many candy bars were there in the 2 boxes?

H Jack went to the circus with 50¢ to spend. Ann went with 38¢ to spend. Ann had how much less money to spend at the circus than Jack?

I Jim had some money when he went to the circus. His father gave him 25¢. Then Jim had $1.00. How much money did Jim have to begin with?

J The children saw 12 men riding ponies. They saw them separate into 3 equal groups. How many men riding ponies were in each group?

K A clown said, "I had 242 balloons to sell this morning, and I sold 78." He had how many balloons left?

L Some clowns were riding ponies. 8 clowns were riding in the first ring, 2 in the second ring, and 5 in the third ring. How many clowns were riding in the three rings?

M Ann paid $.15 for a small box of popcorn. Carol paid $.25 for a larger box. Carol paid how much more than Ann for her popcorn?

N 2 bears were sleeping in one cage, 3 bears were sleeping in the next cage, and 5 were sleeping in a third cage. How many bears were sleeping in the three cages?

O Don had $1.25 when he went to the circus. He wanted to keep some money to spend the next week. He spent 68¢ at the circus. How much money did he keep for the next week?

211

2

211

1 Tell the children to read each problem and write the equation that describes the problem situation, using the screen (or square) for the missing number. Next they should compute to find the missing number and then rewrite the equation.

2 Supply answers so that the children can check their work. If any problems have caused special difficulty, discuss them and clear up the trouble before proceeding with the next lesson.

212-213 Thinking straight

Exponded Notes ore not considered necessary for this lesson.

Objectives

The child becomes acquainted with various ingenious ways to add and subtract mentally.

Vocabulary

New words page 212 my*, head*

Comments

The ability to compute mentally is often of great practical value. Furthermore, children enjoy doing such computation because it challenges them to produce different and possibly more ingenious methods than their friends use.

Mental calculation is actually much easier than it appears to be, but it requires an approach to the handling of numbers different from that used in working with pencil and paper. For example, in adding or subtracting on paper, it is customary to start with the ones' column and work through the tens to the hundreds, etc. But in mental calculation the opposite approach is usually followed: the hundreds or tens are computed first, and the ones last.

In working with the examples, no child should be required to try work beyond his capacity. He should, however, be encouraged to experiment with the short cuts because mental calculation is a tool he will use all through his life. It is not expected that much skill in mental calculation will be achieved in this lesson. Your aim should be to stimulate the child's interest in the short cuts so that the motivation for using some of them will come from within the child himself.

This lesson presents only a few possible methods for adding and subtracting "in one's head," and the children should be encouraged to think of as many other ways as they can. The mental stimulation that goes with such activity is very desirable and helps to develop insight and flexibility in all phases of mathematics.

As much of this work as possible should be done orally. The children should, however, be permitted to use pencil and paper at first, if necessary, to record a figure now and then. Give them time to work out their own methods and allow them to explain these methods to the class. You will undoubtedly find a wide range of ability among the pupils. Some will carry and borrow and will find it hard to use any other method. Others will discover very ingenious ways for doing addition and subtraction mentally. Do not be disturbed by the variance in ability, but let each child succeed on his own level.

Activity 4, page 314, may be used in connection with this lesson.

Answers

Page 212:

(block 1)

A 30+50=80; 6+3=9; 80+9=89

B 50+30=80; 2+2=4; 80−4=76

C 8+8=16; 1+4+2=7; 7 tens 6 ones equal 76

D 49; E 38; F 40 (Let the children explain the methods they use for D, E, and F.)

(block 2)

Let the children explain their methods.

A 70	E 77	I 50	M 87
B 96	F 77	J 56	N 90
C 76	G 73	K 90	O 82
D 41	H 97	L 36	P 86

Page 213:

(block 1)

A Add 1 because you subtracted 1 more than 29.
31+1=32

B Subtract 6 more because you added 6 to 40.
30−6=24

C Subtract 6 because 10 is 6 less than 16.
30−6=24

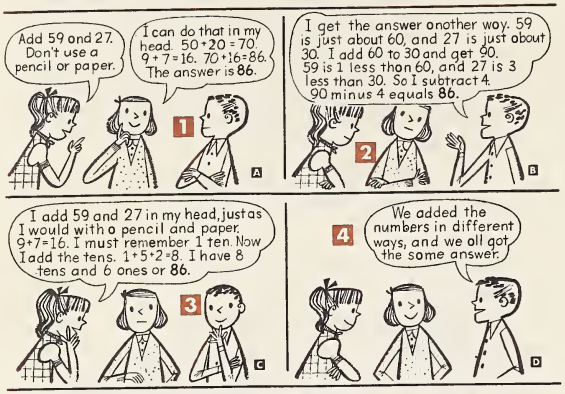
D and E. Let the children explain their methods.

(block 2)

Let the children explain their methods.

A 28	E 62	I 17	M 15
B 23	F 42	J 32	N 16
C 29	G 39	K 39	O 37
D 29	H 16	L 35	P 37

Thinking straight


Add 59 and 27. Don't use a pencil or paper.
I can do that in my head. 50+20=70. 9+7=16. 70+16=86. The answer is 86.
1
A
I get the answer another way. 59 is just about 60, and 27 is just about 30. I add 60 to 30 and get 90. 59 is 1 less than 60, and 27 is 3 less than 30. So I subtract 4. 90 minus 4 equals 86.
2
B
I add 59 and 27 in my head, just as I would with a pencil and paper. 9+7=16. I must remember 1 ten. Now I add the tens. 1+5+2=8. I have 8 tens and 6 ones or 86.
3
C
4
We added the numbers in different ways, and we all got the same answer.
D

A Add 36 to 53 in your head. Use the way shown in Picture A.

B Add 48 to 28 in your head. Use the way shown in Picture B.

C Now use the way shown in Picture C to add 48 to 28.

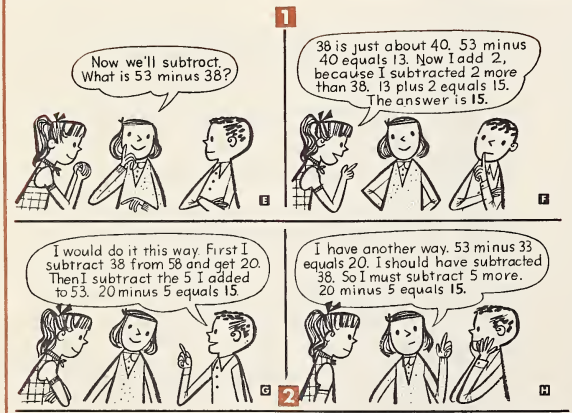
D Add 24 to 25 in your head. How did you do it? **5**

E Add 19 to 19 in your head. How did you do it? **5**

F Use two different ways to add 26 to 14 in your head. **5**

Add in your head. **6**

A	25+45=	E	46+31=	I	21+29=	M	53+34=
B	37+59=	F	50+27=	J	28+28=	N	72+18=
C	54+22=	G	37+36=	K	46+44=	O	47+35=
D	18+23=	H	49+48=	L	19+17=	P	30+56=


1
Now we'll subtract. What is 53 minus 38?
E
38 is just about 40. 53 minus 40 equals 13. Now I add 2, because I subtracted 2 more than 38. 13 plus 2 equals 15. The answer is 15.
F
I would do it this way. First I subtract 38 from 58 and get 20. Then I subtract the 5 I added to 53. 20 minus 5 equals 15.
G
2
I have another way. 53 minus 33 equals 20. I should have subtracted 38. So I must subtract 5 more. 20 minus 5 equals 15.
H

A Subtract 29 from 61 in your head. Use the way shown in Picture F. 61−30=31. What must you add to 31? Why?

B Subtract 16 from 40 in your head. Use the way shown in Picture G. 46−16=30. What must you subtract from 30? Why?

C Now use the way shown in Picture H to subtract 16 from 40. 40−10=30. What must you subtract from 30? Why?

D Subtract 47 from 63 in your head. How did you do it? **3**

E Subtract 23 from 48 in your head. How did you do it? **3**

Subtract in your head. **4**

A	60−32=	E	81−19=	I	54−37=	M	54−39=
B	40−17=	F	77−35=	J	72−40=	N	44−28=
C	68−39=	G	90−51=	K	85−46=	O	60−23=
D	59−30=	H	43−27=	L	97−62=	P	78−41=

212

1 Direct attention to this picture and have the pupils read what the children are saying. Then refer to Exercise A below and call on a pupil to do the addition in the same way.

2 Have the text in this picture read. Refer to Exercise B and ask for a volunteer to do the addition.

3 Do the same for this picture and Exercise C.

4 Let pupils see if they can discover another way to add 59 and 27.

5 Ask a pupil to do this addition and explain his method.

6 Call on pupils at random to add mentally. Let each pupil explain the method he used.

213

1 Have the pupils read what the children in these two pictures are saying. Direct attention to Exercise A and ask a pupil to do the work.

2 Proceed in the same way with these pictures and Exercises B and C.

3 Ask a pupil to do this subtraction and explain his method.

4 Have pupils take turns subtracting these numbers mentally. Let each pupil explain his method.

214-215 Moving forward

Expanded Notes for this lesson are on pages 301-303.

Objectives

The child learns how time is measured and written.

Vocabulary

New words page 214 midnight, minute*, hour

Comments

This lesson introduces some of the words used in talking about time, gives time equivalents, and interprets time span in terms of ordinary experiences. Keep in mind that this lesson is not designed to teach children how to tell time. Such teaching should be a continuous activity both at home and at school, and should always be done by use of a real or toy clock.

Because the clock provides visually for only a twelve-hour span of time, children sometimes do not realize that a day is twenty-four hours long. Pictures A, B, and C relate two consecutive trips of the hour hand with the passage of twenty-four hours and also with the child's daily activities. Picture D illustrates how far the minute hand moves when the second hand makes a complete trip. Picture E shows how far the hour hand moves when the minute hand makes a complete trip. Take precaution that the children do not confuse the word second as a unit of time with second in its ordinal sense.

The children should use the table of equivalents for reference. They may also use the calendar on page 71.

Answers

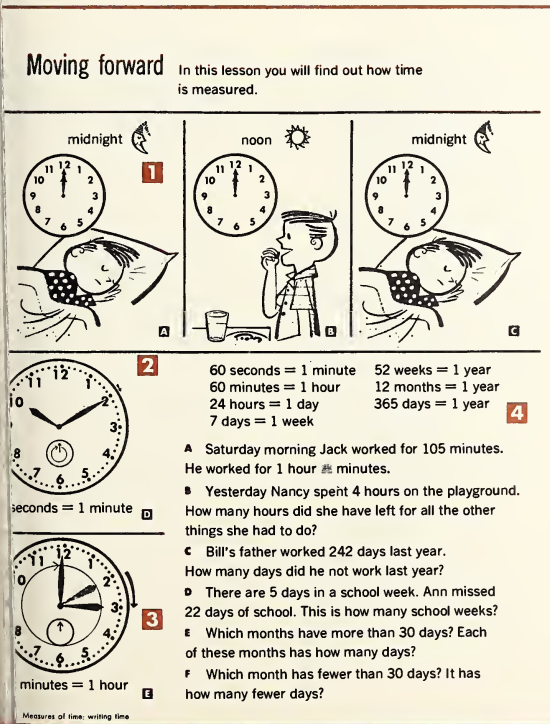
Page 214:

A 1 hour 45 minutes
B 20 hours
C 123 days
D 4 weeks 2 days
E January, March, May, July, August, October, December; 31 days
F February; usually it has 2 fewer days, but in leap years it has 1 fewer.

Page 215:

(block 1)

A 7:10 A.M.
B 1:30 P.M.
C 8:28 P.M.
D 3:43 P.M.
E 9:16 A.M.
F 3:31 A.M.
G 11:08 A.M.
H 12:57 A.M.
I 2:45 P.M.
J 4:20 P.M.
K 5:39 A.M.
L 10:19 P.M.


Moving forward
In this lesson you will find out how time is measured.
midnight
noon
midnight
1
A
B
C
2
60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
52 weeks = 1 year
12 months = 1 year
365 days = 1 year
4
seconds = 1 minute
D
A Saturday morning Jack worked for 105 minutes. He worked for 1 hour ▒ minutes.
B Yesterday Nancy spent 4 hours on the playground. How many hours did she have left for all the other things she had to do?
C Bill's father worked 242 days last year. How many days did he not work last year?
D There are 5 days in a school week. Ann missed 22 days of school. This is how many school weeks?
E Which months have more than 30 days? Each of these months has how many days?
F Which month has fewer than 30 days? It has how many fewer days?
3
minutes = 1 hour
E
Measures of time: writing time

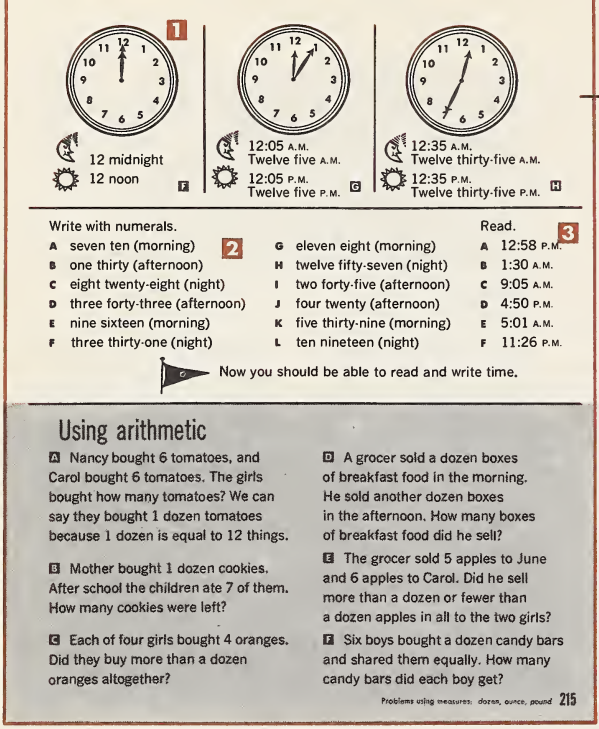
214

1 Direct attention to these pictures and let a pupil tell what he is likely to be doing at midnight and at noon. Use a clock to show how the hour hand makes two complete trips around the clock every twenty-four hours.

2 Point out the second, minute, and hour hands. Explain that the arrow beside the second hand shows that it has made a complete trip in 60 seconds, or 1 minute. The dimmed-off minute hand shows its original position, the arrow shows its direction, and the undimmed hand shows its present position. Explain that this hand moves from one mark to the next (showing 1 minute of time) while the second hand makes a complete trip.

3 Explain here that the minute hand has made one complete trip while the hour hand has moved from 2 to 3.

4 Tell the children to use this table of equivalents when they work Problems A to D.


1
12 midnight
12 noon
F
12:05 A.M.
Twelve five A.M.
12:05 P.M.
Twelve five P.M.
G
12:35 A.M.
Twelve thirty-five A.M.
12:35 P.M.
Twelve thirty-five P.M.
H
Write with numerals.
2
A seven ten (morning)
B one thirty (afternoon)
C eight twenty-eight (night)
D three forty-three (afternoon)
E nine sixteen (morning)
F three thirty-one (night)
G eleven eight (morning)
H twelve fifty-seven (night)
I two forty-five (afternoon)
J four twenty (afternoon)
K five thirty-nine (morning)
L ten nineteen (night)
Read.
3
A 12:58 P.M.
B 1:30 A.M.
C 9:05 A.M.
D 4:50 P.M.
E 5:01 A.M.
F 11:26 P.M.
Now you should be able to read and write time.
Using arithmetic
A Nancy bought 6 tomatoes, and Carol bought 6 tomatoes. The girls bought how many tomatoes? We can say they bought 1 dozen tomatoes because 1 dozen is equal to 12 things.
B Mother bought 1 dozen cookies. After school the children ate 7 of them. How many cookies were left?
C Each of four girls bought 4 oranges. Did they buy more than a dozen oranges altogether?
D A grocer sold a dozen boxes of breakfast food in the morning. He sold another dozen boxes in the afternoon. How many boxes of breakfast food did he sell?
E The grocer sold 5 apples to June and 6 apples to Carol. Did he sell more than a dozen or fewer than a dozen apples in all to the two girls?
F Six boys bought a dozen candy bars and shared them equally. How many candy bars did each boy get?
Problems using measures: dozen, ounce, pound
215

215

1 Direct attention to the pictures. Explain that the hands of a clock are in these positions twice every twenty-four hours—once during the day and once during the night. Explain that A.M. means morning time between midnight and noon and that P.M. means afternoon time between noon and midnight. Relate various A.M. and P.M. "times" to the children's own activities.

2 Let the children describe what they might be doing at the "times" given here. Have the children write them with numbers and A.M. or P.M. and verify their answers.

3 Let pupils take turns reading these.

215-216 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child solves problems involving the following units of measure: dozen, pound, ounce, quart, gallon, inch, foot, and yard.

Vocabulary

New words page 215 dozen; page 216 pound, weighed, ounces

Comments

This set of problems is designed to acquaint the child with the word dozen and to interpret the idea of the ounce as a smaller unit than the pound and the equivalence of 16 ounces and 1 pound.

As in other work with measurement, this lesson is aimed at developing judgment. At the conclusion of the lesson, the children should have an idea of some things that might weigh an ounce and others that might weigh a pound. To help them develop this judgment, have on hand, if possible, a weight scales and objects that vary in weight. Let the children estimate the weights of these objects and verify their estimates by using the weight scales.

Answers

A $6+6=[12]$
B $12-7=[5]$
C $4\times4=[16]$; yes
D $12+12=[24]$
E $5+6=[11]$ or $6+5=[11]$; fewer than
F $12\div[2]=6$
G $16\div[4]=4$
H The book
I $61-56=[5]$
J $2+5+4=[11]$; less than
K $4+6+5=[15]$
L $21-16=[5]$
M 1 pound 3 ounces
N $12-8=[4]$
O Yes; 4 quarts equal 1 gallon.
P $46-41=[5]$
Q 1 yard 2 feet
R $12\div[3]=4$
S $8\div4=[2]$

12 midnight
12 noon F

12:05 A.M.
Twelve five A.M.
12:05 P.M.
Twelve five P.M. G

12:35 A.M.
Twelve thirty-five A.M.
12:35 P.M.
Twelve thirty-five P.M. H

Write with numerals.

A seven ten (morning)
B one thirty (afternoon)
C eight twenty-eight (night)
D three forty-three (afternoon)
E nine sixteen (morning)
F three thirty-one (night)
G eleven eight (morning)
H twelve fifty-seven (night)
I two forty-five (afternoon)
J four twenty (afternoon)
K five thirty-nine (morning)
L ten nineteen (night)

Read.

A 12:58 P.M.
B 1:30 A.M.
C 9:05 A.M.
D 4:50 P.M.
E 5:01 A.M.
F 11:26 P.M.

Now you should be able to read and write time.

Using arithmetic

1 A Nancy bought 6 tomatoes, and Carol bought 6 tomatoes. The girls bought how many tomatoes? We can say they bought 1 dozen tomatoes because 1 dozen is equal to 12 things.

2 B Mother bought 1 dozen cookies. After school the children ate 7 of them. How many cookies were left?

C Each of four girls bought 4 oranges. Did they buy more than a dozen oranges altogether?

D A grocer sold a dozen boxes of breakfast food in the morning. He sold another dozen boxes in the afternoon. How many boxes of breakfast food did he sell?

E The grocer sold 5 apples to June and 6 apples to Carol. Did he sell more than a dozen or fewer than a dozen apples in all to the two girls?

F Six boys bought a dozen candy bars and shared them equally. How many candy bars did each boy get?

Problems using measures: *dozen, ounce, pound* 215

1 A

2

16 ounces = 1 pound B

G Mary bought a pound of butter. It was divided into 4 equal pieces. Each piece weighed how many ounces?

H A box weighs 15 ounces. A book weighs 1 pound. Which weighs more, the box or the book?

I Jack weighs 56 pounds, and Jim weighs 61 pounds. Jim weighs how many pounds more than Jack?

J Betty weighed 3 small packages. They weighed 2 ounces, 5 ounces, and 4 ounces. Did they weigh more than or less than 1 pound altogether?

K A clerk weighed 3 bags of tomatoes. They weighed 4 pounds, 6 pounds, and 5 pounds. How much did all 3 bags weigh?

L A package weighed 21 ounces. This package weighed how much more than 1 pound?

M A package weighed 19 ounces. It weighed 1 pound ▒ ounces.

N Bob measured a page in a book. It was 8 inches long. This is how many inches less than a foot?

O Nancy bought 1 gallon of milk, and Mary bought 4 quarts of milk. Did the two girls buy equal amounts of milk? How do you know?

P Don is 46 inches tall, and Nancy is 41 inches tall. Nancy is how many inches shorter than Don?

Q A table is 5 feet wide. It is 1 yard ▒ feet wide.

R A piece of paper was 1 foot wide. June cut it into 4 equal pieces. Each piece was how many inches wide?

S Mother made 8 quarts of tomato juice. This was equal to how many gallons?

215

1 Discuss how many things make a dozen; let the children name things that are bought by the dozen. Ask a child to read the first sentence and the question in Problem A. After he has given his answer, let him read the last sentence.

2 Call on children at random to read and solve Problems B to F. Then let them write the complete equations on their papers. Tell them that this lesson is continued on the following page, but that they are to stop working on the problems when they finish F, so that everyone can discuss the pictures at the top of the next page together.

216

1 Tell the children to look at this picture. Draw attention to the scale showing ounces and pounds and to the position of the pointer. Call on a pupil to tell how much the package weighs.

2 Direct attention to Picture B. Get the pupils to notice that now there are four boxes on the scales, each one the same size as the one in Picture A. Have the children observe the new position of the pointer. Ask the children what this picture shows about ounces and pounds. Let a child read the statement below the picture aloud.

3 Have the children work independently on Problems G to S. Tell them to write equations and do any computation that is necessary.

217 Thinking straight; Keeping skillful

Exponded Notes are not considered necessory for these lessons.

Objectives

The child learns to use judgment in estimating sizes of familiar objects. He reviews addition and subtraction of two-figure and three-figure numbers, division with remainders, and multiplication and division basic facts.

Vocabulary

New words page 217 doors*

Comments

In "Thinking straight" the children are given an opportunity to make judgments concerning the sizes of familiar things. Allow them to explain and defend their answers. The section may be handled orally.

"Keeping skillful" offers opportunity for practice in adding and subtracting two-figure and three-figure numbers, including amounts of money. It also furnishes exercises for practice in division with remainders and a review of the multiplication and division basic facts. This entire section should be used as written work.

Answers

Keeping skillful:

(block 1)

A 611	F $10.45	K 206	P 170
B $.28	G 337	L $1.10	Q 66
C 74	H 491	M 662	
D 80	I 148	N $.37	
E 193	J $.24	O 129	

(block 2)

A 4 and 4 rm.	J 6 and 1 rm.
B 2 and 4 rm.	K 3 and 3 rm.
C 2 and 1 rm.	L 2 and 3 rm.
D 4 and 1 rm.	M 3 and 3 rm.
E 6 and 2 rm.	N 3 and 2 rm.
F 5 and 1 rm.	O 2 and 2 rm.
G 3 and 2 rm.	P 8 and 1 rm.
H 2 and 4 rm.	Q 3 and 4 rm.
I 2 and 4 rm.	

Thinking straight

1

A About how many feet tall are you?

B If you were making a shelf for your books, would you measure in inches or in feet? Why?

2

C How high would you make the shelf for your books? Why?

D Why are schoolroom doors more than 5 feet high?

E About how long is a big dog?

F About how tall is a big dog?

G How long is a big room?

H How many pounds can you carry?

I About how many feet long do you think your bed is? Why is it that long?

J About how many inches high do you think a table is? Why is it that high?

K A table top is 1 inch more than 7 feet wide and 1 inch more than 7 feet long. Can you take the table top into a room that has a door just 7 feet high? If so, how would you do it?

Keeping skillful

3

A 385 + 226 = ■
B $.92 − $.64 = ■
C 27 + 32 + 15 = ■
D 471 − 391 = ■
E 48 + 93 + 52 = ■
F $7.29 + $3.16 = ■
G 801 − 464 = ■
H 297 + 194 = ■
I 94 + 18 + 36 = ■
J $2.00 − $1.76 = ■
K 625 − 419 = ■
L $.77 + $.33 = ■
M 836 − 174 = ■
N $1.02 − $.65 = ■
O 87 + 13 + 29 = ■
P 92 + 78 = ■
Q 430 − 364 = ■

4

A 24 ÷ 5 = ■ and ■ remainder
B 18 ÷ 7 = ■ and ■ remainder
C 19 ÷ 9 = ■ and ■ remainder
D 25 ÷ 6 = ■ and ■ remainder
E 20 ÷ 3 = ■ and ■ remainder
F 21 ÷ 4 = ■ and ■ remainder
G 14 ÷ 4 = ■ and ■ remainder
H 16 ÷ 6 = ■ and ■ remainder
I 20 ÷ 8 = ■ and ■ remainder
J 25 ÷ 4 = ■ and ■ remainder
K 21 ÷ 6 = ■ and ■ remainder
L 15 ÷ 6 = ■ and ■ remainder
M 24 ÷ 7 = ■ and ■ remainder
N 20 ÷ 6 = ■ and ■ remainder
O 14 ÷ 6 = ■ and ■ remainder
P 25 ÷ 3 = ■ and ■ remainder
Q 25 ÷ 7 = ■ and ■ remainder

5

A 7 × 3 = ■
B 20 ÷ ■ = 4
C 24 ÷ ■ = 8
D 6 × 4 = ■
E 8 × 3 = ■
F 20 ÷ 5 = ■
G 4 × 4 = ■
H 18 ÷ ■ = 6
I 18 ÷ ■ = 9
J 3 × 6 = ■
K 4 × 5 = ■
L 21 ÷ ■ = 3
M 5 × 5 = ■
N 2 × 2 = ■
O 24 ÷ ■ = 6
P 4 × 6 = ■
Q 25 ÷ ■ = 5

217

217

1. Let some of the pupils estimate their height in feet. As a check on these estimates, let pupils measure one another to see how close the estimates were.
2. Let the pupils take turns reading the rest of the questions aloud and answering them. Encourage discussion and allow for differences of opinion about reasonable estimates.
3. Tell the children to copy the numbers in computational form and find the answers.
4. Use these exercises for oral response first. Then tell the children to write the answers. To save work, instruct them to write "rm." for "remainder."
5. Use these exercises for oral response. Then direct pupils to write equations with answers, or just the answers.

218-219 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to make problems from situations shown by pictures. He solves verbal problems.

Vocabulary

New words page 219 carrots

Comments

The four pictures present situations for which the children are to make up problems. Accept any problem that fits the picture. Some examples of problems that might be offered by the pupils are suggested below.

A John has 12 apples and 3 boxes. He wants to put the same number of apples into each box. How many apples can he put into each box?

B At 4¢ each, how much will I have to pay for 4 oranges?

C At 5¢ each, how many pears can I buy for 25¢?

D A grocer had 6 large boxes of cereal and 3 small boxes of cereal. He had how many more large boxes of cereal than small boxes of cereal?

Answers

Page 218:

A, B, C, D. See "Comments."
E [176]+144=320
F 6÷3=[2]
G 24÷[6]=4
H 72−46=[26]
I 28¢÷5¢=[5 and 3¢ remainder]
J 20÷4=[5]

Page 219:

K 3×7¢=[21¢]
L 24÷[8]=3
M $2.45−$.95=[$1.50]
N 4×6=[24]
O 21÷[7]=3
P 3×8¢=[24¢]
Q 2×7=[14]
R 13+[36]=49

Keeping skillful:

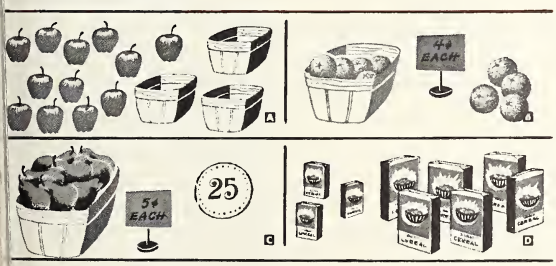
(block 1)

A 3 yards B 3 weeks C 12 pints D 24 feet E 2 gallons F 4 gallons G 12 quarts H 12 months I 14 days J 24 pints K 6 yards L 5 gallons M 24 quarts N 16 ounces

(block 2)

A $1.59 B $1.88 C $7.01 D $.54 E $.26 F $1.91 G $1.63 H $.79 I $7.20 J $2.03 K $1.58 L $3.32 M $2.51 N $1.69

Using arithmetic



A Make a problem for Picture A and find the answer.

B Make a problem for Picture B and find the answer.

C Make a problem for Picture C and find the answer.

D Make two problems for Picture D and find the answers.

E The grocer had some cans of fruit. Then he bought 144 more cans of fruit. Now he has 320 cans of fruit. How many cans of fruit did he have at first?

F A shelf in the store was 6 feet long. The shelf was how many yards long?

G There were 24 apples in a box. The clerk put them into 4 bags. He put an equal number of apples into each bag. How many apples did he put in each bag?

H There were 72 cans of dog food in the store. The clerk sold 46 of them. How many cans of dog food did he have left?

I Don had 28¢ to spend for fruit. He wanted to buy some apples that cost 5¢ apiece. How many apples could he buy? Would he have any money left? How much money would he have left?

J Mother bought 20 quarts of milk one week. This was equal to how many gallons of milk?

218

1 Ask a pupil to read Exercise A. If necessary, help him to make up a problem for the picture by asking him how many apples there are and how many boxes he sees. Have all the children write their problems on paper and take turns reading them aloud. Then have them make equations for their problems and find the answers.

2 Continue with B, C, and D in a similar way.

3 The children should work independently on Problems E to R. Have them make equations and find the answers.

K Jack bought 3 oranges. They cost 7¢ apiece. How much did he pay for the oranges? 1

L The grocer put 24 boxes of breakfast food in 3 piles on a shelf. He put the same number of boxes in each pile. How many boxes did he put in each pile?

M Ann had $2.45. She bought fruit that cost $.95. How much money did she have left?

N There were 4 bags of cookies on a shelf. There were 6 cookies in each bag. How many cookies were in all 4 bags?

O The clerk put 21 carrots in 3 bunches. He put the same number of carrots in each bunch. How many carrots did he put in each bunch?

P Ellen bought 3 bunches of carrots at 8¢ a bunch. How much did she pay for the carrots?

Q Tom bought 2 bunches of carrots. There were 7 carrots in each bunch. How many carrots did he buy?

R The grocer had 13 cans of tomato soup. He bought more tomato soup on Saturday. Then he had 49 cans of tomato soup. How many cans did he buy on Saturday?

2 Keeping skillful

A 9 feet = ▢ yards
B 21 days = ▢ weeks
C 6 quarts = ▢ pints
D 8 yards = ▢ feet
E 16 pints = ▢ gallons
F 16 quarts = ▢ gallons
G 3 gallons = ▢ quarts
H 1 year = ▢ months
I 2 weeks = ▢ days
J 3 gallons = ▢ pints
K 18 feet = ▢ yards
L 20 quarts = ▢ gallons
M 6 gallons = ▢ quarts
N 1 pound = ▢ ounces

3

A $2.45 − $.86 = ▢
B $.98 + $.63 + $.27 = ▢
C $4.13 + $2.88 = ▢
D $7.03 − $6.49 = ▢
E $.43 − $.17 = ▢
F $.56 + $1.35 = ▢
G $.46 + $.92 + $.25 = ▢
H $1.17 − $.38 = ▢
I $5.30 + $1.90 = ▢
J $7.53 − $5.50 = ▢
K $.29 + $.52 + $.77 = ▢
L $8.21 − $4.89 = ▢
M $1.80 + 62¢ + 9¢ = ▢
N $5.60 − $3.91 = ▢

4

A 3 × 8 = ▢
B 4 × 5 = ▢
C 24 ÷ 8 = ▢
D 25 ÷ 5 = ▢
E 3 × 6 = ▢
F 14 ÷ ▢ = 2
G 3 × 7 = ▢
H 20 ÷ 4 = ▢
I 3 × 5 = ▢
J 24 ÷ ▢ = 4
K 7 × 3 = ▢
L 5 × 4 = ▢
M 3 × 3 = ▢
N 15 ÷ 5 = ▢

219

219

1 The children should continue to make the equations and find the answers. When they have finished, provide answers with which they can compare theirs. Discuss any problems that have been difficult for the class.
2 These exercises may be handled as either oral or written work.
3 Tell the children to write each example in computational form and compute.
4 Call on children at random to complete these basic facts orally. Then, if you wish, you may ask them to write the completed equations on their papers, or just the missing numbers.

220-224 Moving forward

Expanded Notes for this lesson are on pages 303-304.

Objectives

The child learns the multiplication basic facts for the 27, 28, 30, 32, 35, and 36 groups.

Vocabulary

There are no new words in this lesson.

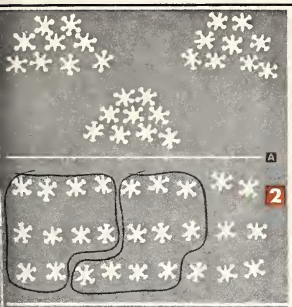
Comments

This lesson completes the work on multiplication basic facts for Grade 3. Each basic fact is pictured, and groups of ten are ringed so that identification of the total is simplified. It is wise to proceed slowly and make sure that the children know these basic facts thoroughly before going on to new work.

Additional experiences with these basic facts can be provided by having the children make other problems using them. They can make their own drawings (circles, squares, dots, etc.) to illustrate the objects mentioned in their problems. Direct them to encircle groups of 10 to find the total number. Be sure they observe how many tens there are and how many extra dots, circles, or squares. Thus, for 3 nines they should find 2 tens and have 7 dots or circles or squares not in any ring.

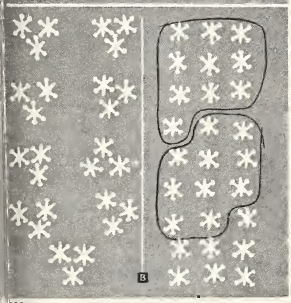
Moving forward

You will now learn how to multiply to make 27, 28, 30, 32, 35, and 36.



3 girls are going to play jacks.
Each girl has 9 jacks. The girls have how many jacks in all? 1

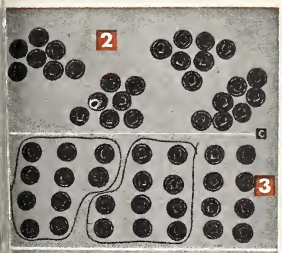
3 nines = ■
9 multiplied by 3 = ■
Multiply 9 by 3. 3 times 9 = ■ 3
3 × 9 = ■



9 girls are going to play jacks.
Each girl has 3 jacks. The girls have how many jacks in all? 4

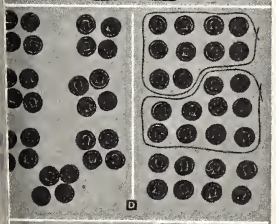
9 threes = ■
3 multiplied by 9 = ■
Multiply 3 by 9. 9 times 3 = ■
9 × 3 = ■

220 Multiplication basic facts for the 27, 28, 30, 32, 35, and 36 groups



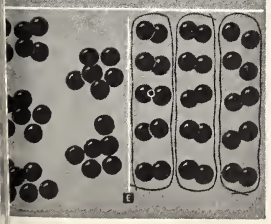
Jim saved 7 cents a day for 4 days. 1
How much money did he save in all?

4 sevens = ■
7 multiplied by 4 = ■ 4
Multiply 7 by 4. 4 times 7 = ■
4 × 7 = ■



Bill saved 4 cents each day for 7 days.
How much money did he save in all?

7 fours = ■
4 multiplied by 7 = ■ 5
Multiply 4 by 7. 7 times 4 = ■
7 × 4 = ■



5 boys were going to play marbles.
Each boy had 6 marbles.
How many marbles did the boys have in all? 5

5 sixes = ■
6 multiplied by 5 = ■
Multiply 6 by 5. 5 times 6 = ■
5 × 6 = ■

221

220

1 Call on a pupil to read the first three lines of text. Relate the problem to Scene 1 of Movie A. Be sure the children can identify the number that stands for the size of the group and the number that stands for the number of groups.

2 Direct attention to Scene 2. Get the children to observe that now the 3 groups of jacks are together in one large group. Ask what is suggested when equal small groups join to form a larger group. Ask what the rings are for [to show tens]. Have a pupil tell how many jacks there are altogether.

3 Ask a pupil to read these different ways of describing what the movie shows, saying the missing numbers.

4 Treat this movie and its text in a similar way.

221

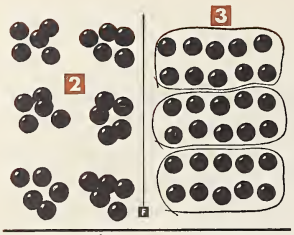
1 Ask someone to read this problem aloud.

2 Relate the first scene of Movie C to the problem. Ask how many pennies are in each group and how many groups there are.

3 Direct attention to the second scene. Ask what has happened to the groups of pennies. Let a pupil tell what is suggested when equal groups join to form a larger group. Point out that the two ringed groups of 10 will help the children see the total number. Ask a child how many pennies there are altogether.

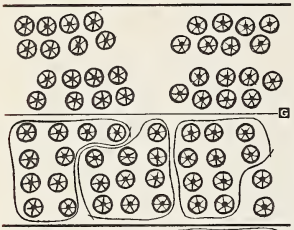
4 Call on a child to read and complete these equations and statements.

5 Treat this movie and its text in a similar way.



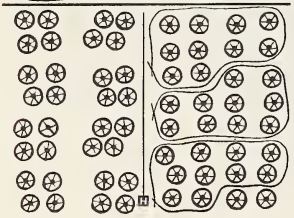
6 boys were going to play marbles. Each boy had 5 marbles. How many marbles did the boys have in all? 1

6 fives = ▩
5 multiplied by 6 = ▩ 4
Multiply 5 by 6. 6 times 5 = ▩
6 × 5 = ▩



The boys are going to make 4 toys. They need 8 wheels for each toy. How many wheels do they need in all? 5

4 eights = ▩
8 multiplied by 4 = ▩
Multiply 8 by 4. 4 times 8 = ▩
4 × 8 = ▩

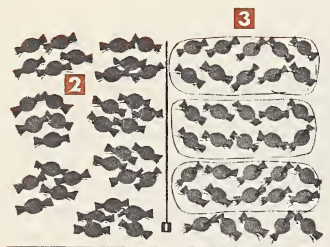


The boys are going to make 8 toys. They need 4 wheels for each toy. How many wheels do they need in all? 5

8 fours = ▩
4 multiplied by 8 = ▩
Multiply 4 by 8. 8 times 4 = ▩
8 × 4 = ▩

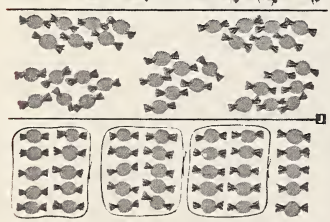
222

1. Have someone read this problem.
2. Call attention to the first scene of Movie F. Ask how many marbles are in each group and how many groups there are.
3. Direct attention to the second scene. Ask what is suggested when equal groups join to form a larger group. Let a pupil tell why groups of 10 are ringed. Ask how many marbles there are in all.
4. Have a pupil read and complete these equations and statements.
5. Use a similar treatment for this movie and its text.



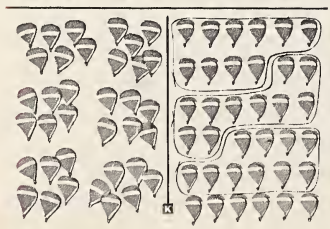
Mother had some candy. She gave 5 pieces to each of 7 children. How many pieces of candy did she give to the children? 1

7 fives = ▩
5 multiplied by 7 = ▩
Multiply 5 by 7 4
7 times 5 = ▩
7 × 5 = ▩



Father had some candy. He gave 7 pieces to each of 5 children. How many pieces of candy did he give to the children? 5

5 sevens = ▩
7 multiplied by 5 = ▩
Multiply 7 by 5.
5 times 7 = ▩
5 × 7 = ▩

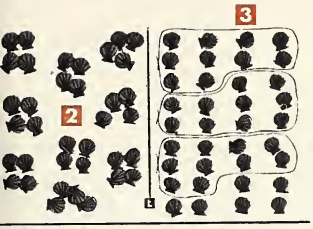


The man in the store had some tops. He sold 6 tops to each of 6 boys. How many tops did he sell in all? 5

6 sixes = ▩
6 multiplied by 6 = ▩
Multiply 6 by 6
6 times 6 = ▩
6 × 6 = ▩

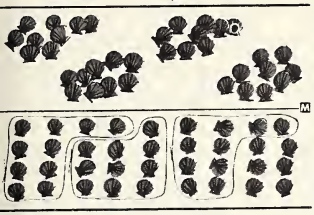
223

1. Ask a pupil to read this problem aloud.
2. Direct attention to the first scene of Movie I. Let a pupil tell how many pieces of candy are in each group and how many groups of candy there are.
3. Make sure the children see that the small groups in the first scene have now combined to make one large group. Ask what is suggested when equal groups join to form one large group. Ask what the rings show. Have a pupil tell how many pieces of candy there are altogether.
4. Call on a child to read and complete these equations and statements.
5. Use a similar procedure for this movie and its text.



Carol saved little shells. She saved 4 shells each day for 9 days. How many shells did she save in the 9 days?

9 fours = ■
4 multiplied by 9 = ■
Multiply 4 by 9.
9 times 4 = ■
9 × 4 = ■



June saved shells, also. She saved 9 shells each day for 4 days. How many shells did she save in the 4 days?

4 nines = ■
9 multiplied by 4 = ■
Multiply 9 by 4.
4 times 9 = ■
4 × 9 = ■

A 6×6=■
B 4×7=■
C 9×3=■
D 5×6=■
E 4×8=■
F 7×5=■
G 9×4=■
H 6×5=■
I 3×9=■
J 5×7=■

K 8×4=■
L 4×9=■
M 7×4=■

A 6×6=■
B 4×9=■
C 5×7=■
D 8×4=■
E 5×6=■
F 9×4=■

G 4×7=■
H 2×8=■
I 5×5=■
J 5×3=■
K 3×8=■
L 6×5=■
M 7×4=■
N 8×3=■
O 2×7=■
P 4×9=■

Q 7×3=■
R 5×4=■
S 6×3=■
T 4×8=■
U 6×4=■
V 3×9=■
W 3×7=■
X 9×3=■
Y 7×5=■
Z 8×3=■

Now you should be able to multiply to make 27, 28, 30, 32, 35, and 36.

24

224

1. Have this problem read aloud.
2. Tell the class to look at the first scene of Movie L. Have a child tell the number of shells in each group and how many groups of shells there are.
3. Call on a pupil to explain the second scene. He should note that the equal groups have now been combined into one large group and should recognize this as a multiplicative situation. Have another pupil tell how many shells there are altogether, using the ringed groups to help him see the number.
4. Ask a pupil to read and complete these statements.
5. Proceed in a similar way with this movie and its text.
6. Let pupils take turns reading and completing Exercises A to M. Then have them write the complete equations, or just the answers.
7. First have the answers given orally. Then let the children write the answers.

225-229 Moving forward

ponded Notes for this lesson are on page 304.

bjectives

he child learns the division facts for the 27, 28, 30, 2, 35, and 36 groups.

ocabulary

here are no new words in this lesson.

mments

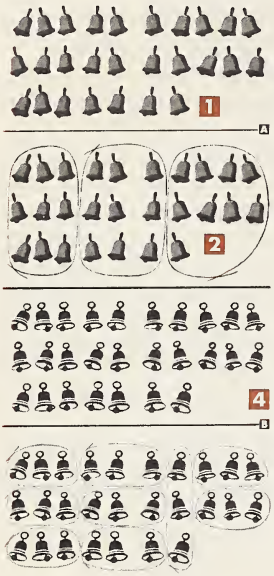
vision basic facts for the groups 27, 28, 30, 32, 35, d 36 are presented with pictures and equations. Each vision basic fact is pictured in a two-scene movie. e first scene shows the total group of objects, arnged as far as possible in rows of 10. In the second ene the same objects are ringed to show separation o equal groups.

The work in this lesson completes the teaching on ision basic facts for Grade 3 in this program. Give children ample time and opportunity to master these ic facts before going on to new work. Many children will benefit if they are allowed to manipulate objects on their desks when studying the groups taught in this lesson.

Additional experiences with these basic facts can be provided by having the children make other problems using them. They can make their own drawings (circles, squares, dots, etc.). Direct them to arrange the objects in their pictures in rows of 10 and extra ones and then to encircle the number of objects that are in the equal groups. Be sure the children make up problems that require the finding of the number of equal groups, not the size of the equal groups.

Moving forward

Now you will learn how to divide 27, 28, 30, 32, 35, and 36 into equal groups.

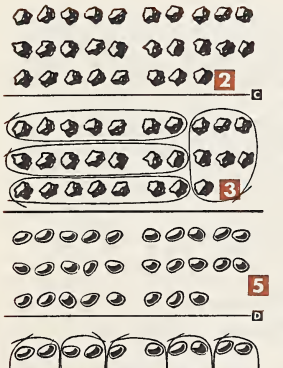


There are 27 bells in the store. The clerk wants to put them into boxes. He wants to put 9 bells into each box. How many boxes will he need?

27 divided by 9 = ■
Divide 27 by 9. 27 ÷ 9 = ■ 3

There are 27 other bells in the store. The clerk is going to put them into boxes. He is going to put 3 bells into each box. How many boxes will he need?

27 divided by 3 = ■
Divide 27 by 3. 27 ÷ 3 = ■

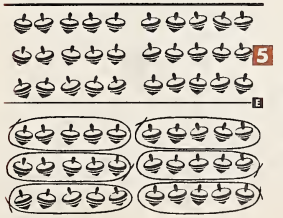


Don separated 28 small stones into groups. He put 7 stones into each group. How many groups of stones did he have?

28 divided by 7 = ■
Divide 28 by 7. 28 ÷ 7 = ■ 4

Tom put his 28 small stones into groups, also. He put 4 stones into each group. How many groups of stones did he have?

28 divided by 4 = ■
Divide 28 by 4. 28 ÷ 4 = ■



There are 30 tops in the store. The clerk is going to put them into boxes. He is going to put 5 tops into each box. How many boxes will he need?

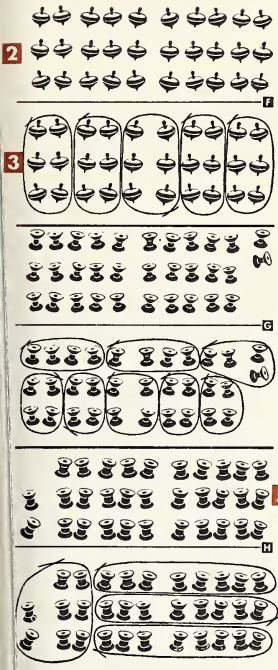
30 divided by 5 = ■
Divide 30 by 5. 30 ÷ 5 = ■

225

1. Get the children to observe that there are 27 bells in this scene [2 rows of 10, arranged in groups of 5, and 7 bells]. Let one child read these four lines of text.
2. Direct attention to this scene. Explain that the rings around groups indicate that the bells are to be thought of as separated into equal groups. Help the children understand that this suggests division. Let a child tell how many bells are in each group and how many groups there are.
3. Ask a pupil to read these expressions, saying the missing numbers. Then ask how many boxes the clerk will need for the 27 bells. Be sure the children understand the change from "groups" to "boxes."
4. Follow a similar procedure for this movie and its text.

226

1. Let one pupil read these four lines of text.
2. Direct the class to look at this scene. Ask a pupil to tell how many stones there are. Remind him to use the arrangement of 2 tens and 8 single stones to help him determine the total.
3. Direct attention to this scene. Get the class to tell how many stones there are in each of the ringed groups and how many groups of 7 there are.
4. Let a child read these expressions, supplying the missing numbers.
5. Use a similar treatment for this movie and its text.
6. Be sure the children understand the change from "groups" to "boxes."



There are 30 tops in the store. The clerk wants to put them into boxes. He wants to put 6 tops into each box. How many boxes will he need?

30 divided by 6 = ■
Divide 30 by 6. 30 ÷ 6 = ■

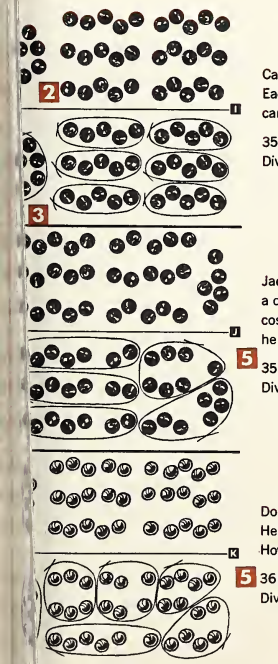
The boys used 32 spools for some toys that they made. They used 4 spools for each toy. How many toys did they make?

32 divided by 4 = ■
Divide 32 by 4. 32 ÷ 4 = ■

The boys used 32 spools for some other toys that they made. They used 8 spools for each toy. How many of these toys did they make?

32 divided by 8 = ■
Divide 32 by 8. 32 ÷ 8 = ■

227



Carol has 35 cents to buy some candy bars. Each candy bar costs 5 cents. How many candy bars can she buy?

35 divided by 5 = ■
Divide 35 by 5. 35 ÷ 5 = ■

Jack has 35 cents, also. He is going to buy a different kind of candy bar. Each candy bar costs 7 cents. How many candy bars can he buy?

35 divided by 7 = ■
Divide 35 by 7. 35 ÷ 7 = ■

Don is going to put 36 marbles into bags. He is going to put 6 marbles into each bag. How many bags will he need for the marbles?

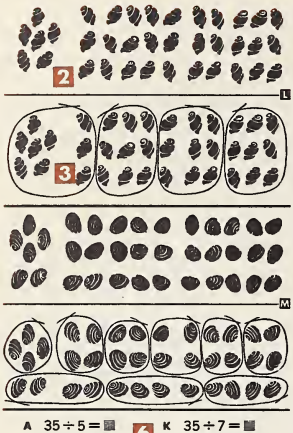
36 divided by 6 = ■
Divide 36 by 6. 36 ÷ 6 = ■

227

1. Call on a pupil to read these four lines of text.
2. Ask a child to tell how many tops there are in this scene of Movie F, using the arrangement in tens to help him find the total.
3. Get someone to explain what the rings in this scene suggest. Let another child tell how many tops are in each group and how many groups of 6 there are.
4. Let one pupil read these expressions, saying the missing numbers. Ask him how many boxes the clerk will need for the 30 tops.
5. Treat this movie and text in a similar way.

228

1. Ask a pupil to read these three lines of text.
2. Direct attention to this scene of Movie I. Ask a child to tell how many cents are in the picture. Get him to explain how the arrangement of the coins (in tens) helps to find the total.
3. Direct attention to this scene. Ask how many cents are in each of the equal groups. Ask how many groups of 5 there are.
4. Let a pupil read these expressions, saying the missing numbers. Then let a pupil explain the story of the whole movie. He should say something like this: "The first picture shows the 35 cents Carol has. Each candy bar she wants to buy costs 5 cents. To see how many she can buy, she divides her 35 cents into groups of 5 cents each. She has 7 groups; so her 35 cents will buy 7 candy bars."
5. Follow a similar procedure for this movie and its text.



Betty is going to put 36 shells into boxes. She is going to put 9 shells into each box. How many boxes will she need for the shells? 1

36 divided by 9 = ■
Divide 36 by 9. 36 ÷ 9 = ■ 4

Ellen has 36 shells, also. She is going to put her shells into boxes. She is going to put 4 shells into each box. How many boxes will she need? 5

36 divided by 4 = ■
Divide 36 by 4. 36 ÷ 4 = ■

6

A 35 ÷ 5 = ■
B 27 ÷ 9 = ■
C 30 ÷ 6 = ■
D 36 ÷ 4 = ■
E 28 ÷ 7 = ■
F 32 ÷ 4 = ■
G 27 ÷ 3 = ■
H 36 ÷ 6 = ■
I 32 ÷ 8 = ■
J 28 ÷ 4 = ■

K 35 ÷ 7 = ■
L 30 ÷ 5 = ■
M 36 ÷ 9 = ■

7

A 28 ÷ 4 = ■
B 32 ÷ 8 = ■
C 27 ÷ 9 = ■
D 35 ÷ 5 = ■
E 30 ÷ 6 = ■
F 36 ÷ 4 = ■

7

G 16 ÷ 4 = ■
H 27 ÷ 3 = ■
I 21 ÷ 7 = ■
J 25 ÷ 5 = ■
K 18 ÷ 2 = ■
L 35 ÷ 7 = ■
M 24 ÷ 4 = ■
N 36 ÷ 6 = ■
O 20 ÷ 4 = ■
P 30 ÷ 5 = ■

Q 24 ÷ 6 = ■
R 28 ÷ 7 = ■
S 20 ÷ 5 = ■
T 18 ÷ 6 = ■
U 24 ÷ 8 = ■
V 32 ÷ 4 = ■
W 21 ÷ 3 = ■
X 24 ÷ 3 = ■
Y 36 ÷ 9 = ■
Z 25 ÷ 5 = ■

Now you should know how to divide 27, 28, 30, 32, 35, and 36 into equal groups.

229

229

1 Let a pupil read these five lines of text.
2 Ask the class to look at this scene of Movie L and let one child tell how many shells there are.
3 Call attention to this scene and let one pupil explain it in terms of the problem, telling how many are in each group and how many groups of 9 Betty will have. Then ask him how many boxes of 9 shells there will be.
4 Ask a child to read these expressions, saying the missing numbers.
5 Treat this movie and its text similarly.
6 Call on pupils in turn to read aloud and complete the division basic facts (A to M). Have them also write the equations with the missing numbers in them, if you wish.
7 The children may take turns reading aloud these mixed division basic facts (A to Z), saying the answers. They also may write the equations with the missing numbers.

230 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child checks up on his ability to recall multiplication and division basic facts.

Vocabulary

There are no new words in this lesson.

Comments

These end-of-block tests are not speed tests, so give the pupils sufficient time to complete them. Give only as many of these tests at one time as you feel your class can complete comfortably.

Test 1 is on all the multiplication basic facts for 27, 28, 30, 32, 35, and 36. Test 2 covers all the division basic facts for 27, 28, 30, 32, 35, and 36. In Test 3 the same division basic facts are presented in equations with a screen placed in the position of the divisor. Test 4 is a review of mixed multiplication and division basic facts.

1 Checking up 2

Test 1	Test 2
A 7×5=■	A 28÷7=■
B 9×3=■	B 27÷9=■
C 5×6=■	C 30÷5=■
D 4×8=■	D 35÷7=■
E 7×4=■	E 32÷4=■
F 6×6=■	F 27÷3=■
G 5×7=■	G 36÷9=■
H 3×9=■	H 30÷6=■
I 4×7=■	I 28÷4=■
J 4×9=■	J 36÷6=■
K 6×5=■	K 32÷8=■
L 8×4=■	L 36÷4=■
M 9×4=■	M 35÷5=■

3

Test 3
A 28÷■=4
B 35÷■=5
C 27÷■=9
D 30÷■=6
E 36÷■=6
F 27÷■=3
G 30÷■=5
H 28÷■=7
I 36÷■=4
J 32÷■=4
K 35÷■=7
L 32÷■=8
M 36÷■=9

4

Test 4
A 7×5=■
B 32÷4=■
C 30÷■=6
D 6×6=■
E 28÷7=■
F 9×3=■
G 32÷■=8
H 8×4=■
I 6×5=■
J 27÷■=9
K 35÷7=■
L 9×4=■
M 36÷4=■

Using arithmetic

A A grocer keeps his store open 6 days a week. How many days is it open in 6 weeks?

B 36 cans of peaches were in one box, and 48 cans of peaches were in another box. How many cans of peaches were in the two boxes?

C After the grocer bought 48 boxes of tomatoes, he had 80 boxes to sell. How many boxes of tomatoes did he have at first?

D Three boys bought 6 apples and shared them equally. How many apples did each boy get?

E Ann had 30¢. How many cupcakes could she buy at 6¢ each?

F Mother bought 18 oranges. She bought how many more than or how many fewer than 1 dozen oranges?

G When Mother got home, she emptied 2 boxes of tomatoes and put them away. There were 8 tomatoes in each box. There were how many tomatoes in all?

H Mother emptied 2 bags of cookies on a plate. There were 12 cookies in one bag and 9 cookies in the other bag. How many cookies did Mother put on the plate?

238 End-of-block tests on multiplication and division basic facts for 27, 28, 30, 32, 35, and 36

230

1 The pupils should write the completed equations opposite the identifying letters.

2 Follow the same procedure for this test.

3 For each example the children should write what they are to do ["Divide 28 by 4" in Example A]. Then they should rewrite the equation, supplying the missing number.

4 Have pupils write completed equations for Test 4. When the missing number is the divisor, as in Example C, tell them to write also what they must think [divide 30 by 6] to find the answer.

230-231 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child solves problems that require writing equations and the use of addition, subtraction, multiplication, and division.

Vocabulary

There are no new words in this lesson.

Comments

Procedures used for other similar sets of problems should be followed here. The children should work independently and write the proper equation for each problem.

Encourage ingenuity when the children make up problems to fit Pictures A, B, C, and D on page 231 and accept any problems that fit the pictures. Some problems that might be offered are given below:

A How many of the pint bottles of milk would be needed to fill the two quart bottles? Would any pint bottles be left over? If so, how many?

B I have a dollar to spend. Can I buy the three things shown in Picture B? Would I have any money left over? How much money would I have left over?

C If I put an equal number of oranges into each bag in Picture C, how many will there be in each bag? How many will be left over?

D Is there more than or less than 1 gallon of milk in Picture D?

Answers

Page 230:

A 6×6=[36]
B 36+48=[84] or 48+36=[84]
C [32]+48=80
D 6÷[2]=3
E 30¢÷6¢=[5]
F 18−12=[6]; 6 more
G 2×8=[16]
H 12+9=[21] or 9+12=[21]

Page 231:

I 3×4=[12]
J 27¢÷[9¢]=3
K 15+[24]=39
L 14−11=[3]
M $5.00−$4.28=[$.72]
N $.47+$.96+$.28=[$1.71]

Checking up

Test 1	Test 2	Test 3	Test 4
A 7 × 5 = ■	A 28 ÷ 7 = ■	A 28 ÷ ■ = 4	A 7 × 5 = ■
B 9 × 3 = ■	B 27 ÷ 9 = ■	B 35 ÷ ■ = 5	B 32 ÷ 4 = ■
C 5 × 6 = ■	C 30 ÷ 5 = ■	C 27 ÷ ■ = 9	C 30 ÷ ■ = 6
D 4 × 8 = ■	D 35 ÷ 7 = ■	D 30 ÷ ■ = 6	D 6 × 6 = ■
E 7 × 4 = ■	E 32 ÷ 4 = ■	E 36 ÷ ■ = 6	E 28 ÷ 7 = ■
F 6 × 6 = ■	F 27 ÷ 3 = ■	F 27 ÷ ■ = 3	F 9 × 3 = ■
G 5 × 7 = ■	G 36 ÷ 9 = ■	G 30 ÷ ■ = 5	G 32 ÷ ■ = 8
H 3 × 9 = ■	H 30 ÷ 6 = ■	H 28 ÷ ■ = 7	H 8 × 4 = ■
I 4 × 7 = ■	I 28 ÷ 4 = ■	I 36 ÷ ■ = 4	I 6 × 5 = ■
J 4 × 9 = ■	J 36 ÷ 6 = ■	J 32 ÷ ■ = 4	J 27 ÷ ■ = 9
K 6 × 5 = ■	K 32 ÷ 8 = ■	K 35 ÷ ■ = 7	K 35 ÷ 7 = ■
L 8 × 4 = ■	L 36 ÷ 4 = ■	L 32 ÷ ■ = 8	L 9 × 4 = ■
M 9 × 4 = ■	M 35 ÷ 5 = ■	M 36 ÷ ■ = 9	M 36 ÷ 4 = ■

Using arithmetic 1

A A grocer keeps his store open 6 days a week. How many days is it open in 6 weeks?

B 36 cans of peaches were in one box, and 48 cans of peaches were in another box. How many cans of peaches were in the two boxes?

C After the grocer bought 48 boxes of tomatoes, he had 80 boxes to sell. How many boxes of tomatoes did he have at first?

D Three boys bought 6 apples and shared them equally. How many apples did each boy get?

E Ann had 30¢. How many cupcakes could she buy at 6¢ each?

F Mother bought 18 oranges. She bought how many more than or how many fewer than 1 dozen oranges?

G When Mother got home, she emptied 2 boxes of tomatoes and put them away. There were 8 tomatoes in each box. There were how many tomatoes in all?

H Mother emptied 2 bags of cookies on a plate. There were 12 cookies in one bag and 9 cookies in the other bag. How many cookies did Mother put on the plate?

1 I Mother keeps some empty boxes for the children to play with. Yesterday she gave 4 boxes each to Ann, Carol, and Don. She gave them how many boxes in all?

J Mother paid 27¢ for 3 bunches of carrots. How much did each bunch of carrots cost her?

K The grocer had fifteen bottles of chocolate milk this morning. After he bought some more, he had 39 bottles. How many bottles of chocolate milk did he buy?

L He sold 14 cans of cat food yesterday and 11 cans today. He sold how many fewer cans today than he did yesterday?

M Ellen went to the store with $5. She spent $4.28 for food. How much money did she have left?

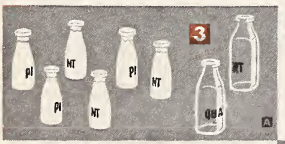
N Dick bought 3 things at the store. One cost $.47, another cost $.96, and the third cost $.28. How much did Dick pay for all 3 things?

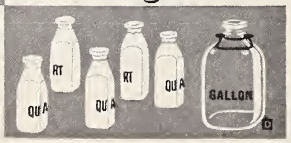
O Make a problem for Picture A and find the answer. 2

P Make 2 problems for Picture B and find the answers. 4

Q Make a problem for Picture C and find the answer.

R Make a problem for Picture D and find the answer.





230

1 The children should work independently on these problems. Remind them to write an equation for each one.

231

1 Have the pupils continue to work independently on problems I to N.

2 Call on a pupil to read this statement.

3 Have the class look at Picture A. Ask a child to think of a problem for the picture and have him tell it to the class. Then have all the pupils write a problem for the picture. Encourage them to think of problems different from the one they have just heard. Each pupil should write an equation for his problem and solve it.

4 Continue with Exercises P, Q, and R and their pictures in a similar way.

232-235 Moving forward

Expanded Notes for this lesson are on poges 304-307.

Objectives

The child finds a common divisor of two groups. He also makes two groups that are a common multiple of two given smaller groups.

Vocabulary

New words page 233 both*

Comments

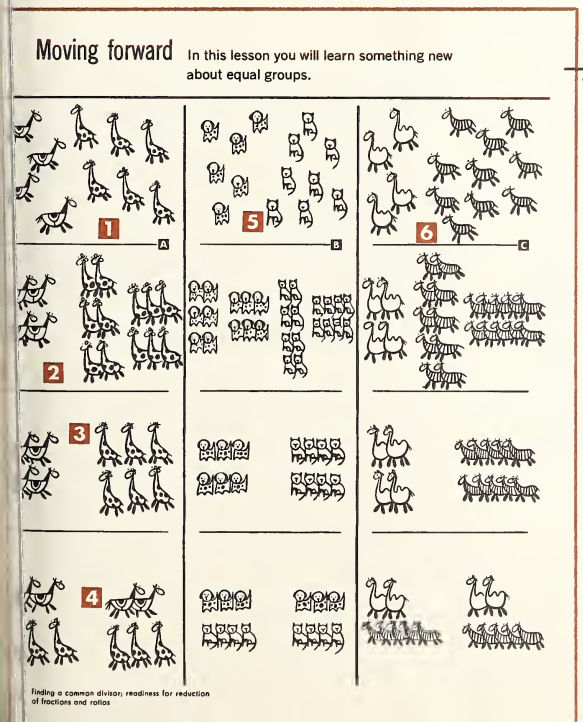
The material in this lesson has been included to help the child look at two kinds of objects and make numerical observations and discoveries about them. The ultimate objective is to get the child to the point where he will understand what he is doing when he finds a common divisor for two or more numbers or finds a common multiple for two or more numbers. He will need this kind of thinking in later work with fractions when he is required to reduce fractions.

Many children will be helped if they are allowed to make marks on their papers to indicate the two kinds of objects in a given picture. In Movie A on page 232, for example, they could use X's for the horses and O's for the giraffes. Such assistance will be especially meaningful when they come to written work that is unaccompanied by pictures (Exercises A to E, bottom of page 233, for example).

Answers

Page 235:

A 12 toy dogs; 15 toy sheep
B 8 horses
C 6 cows; 15 sheep
D 3 boxes; 9 peanut butter sandwiches
E 8 cookies
F 12 candy sticks



232

1 Get pupils to observe that there are 4 horses and 6 giraffes in the first scene.

2 Point out that all the equal groups into which it is possible to divide the horses and giraffes are shown here. Get the children to observe that the horses can be divided into 2 groups of 2 and that the giraffes can be divided into 3 groups of 2 or 2 groups of 3.

3 Get the children to see that both the horses and giraffes can be divided into 2 groups.

4 They should now understand that they can make 2 *sets* of 2 horses and 3 giraffes each.

5 Have pupils notice the number of cats and number of dogs in the first scene. In the second scene they should see that the cats and dogs are divided into all possible equal groups. Have them select the groupings that show the *same number of groups* for cats and dogs. Get them to tell why the cats and dogs can be arranged in 2 sets of 3 dogs and 4 cats.

6 Adapt the procedures used for Movies A and B.

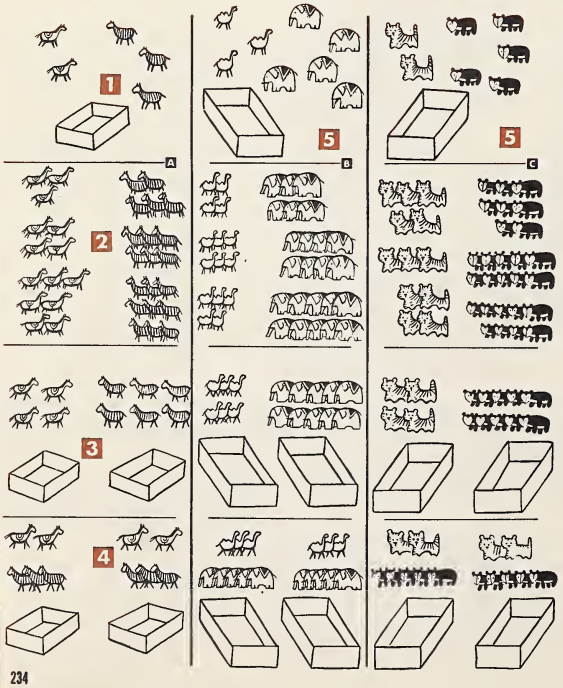
A Divide the cows in Picture E into equal groups. Divide the sheep into equal groups. Do you have the same number of equal groups of cows and sheep?
Can you divide both 6 and 10 by 3?
Can you divide both 6 and 10 by 2?

B In Picture F can you divide the elephants and the horses into the same number of equal groups?
How many elephants will be in each group?
How many horses will be in each group?
Can you divide both 6 and 8 by 2?
Can you divide both 6 and 8 by 4?

C Look at Picture G.
Can you divide both 8 and 10 by 5?
Can you divide both 8 and 10 by 2?

A Can you divide both 8 and 12 by 4?
B Can you divide both 9 and 12 by 3?
C By what number can you divide both 10 and 15?
D By what number can you divide both 6 and 9?
E By what number can you divide both 4 and 10?

233



234

233

1 In the second scene of this movie the children should see that the lions shown in the first scene can be divided into only 3 groups of 3 and that the tigers can be divided into 6 twos or 4 threes or 3 fours or 2 sixes. Get them to see that, since there are 3 equal groups of lions, they are to select the 3 equal groups of tigers [3 fours]. Let a child describe the sets he can make [3 sets of 3 lions and 4 tigers].

2 Help the children see that there are two possible ways of making equal groups of both cows and sheep. Get them to see that the number of sets they can finally make [2 sets of 3 cows and 5 sheep] shows them into which number of groups *both* can be divided.

3 Adapt Notes 1 and 2 for this picture.

4 For Picture G have the children find into what number of smaller groups each group of sheep and dogs can be divided.

5 Allow the children to use objects, if necessary.

234

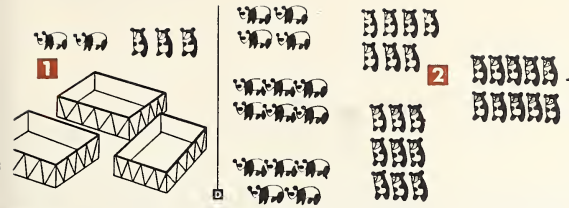
1 Tell the children that the 2 horses and the 3 zebras make a set that belongs in the box. Draw attention to the boxes below and explain that 2 sets of animals like those in Scene 1 will be needed.

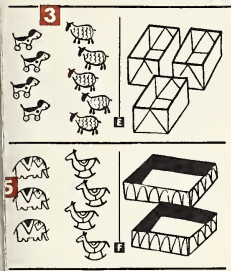
2 Ask the pupils to look at the horses in the second scene and find the group [4 horses] that will make two sets. Then direct attention to the zebras and have them find the group [6 zebras] that will make two sets.

3 Get the children to observe that of all the groups shown only two [4 horses, 6 zebras] have the correct number to make sets for the two boxes.

4 The pupils should note that now the horses and zebras have been grouped into sets and can be put into the boxes.

5 Adapt the procedure used for Movie A.



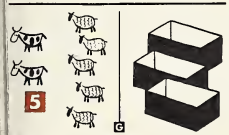


A Look at Picture E. For 3 boxes, we need 3 times 4 toy dogs, or ▒ toy dogs. How many toy sheep do we need? 4

B In Picture F we need 6 elephants for the 2 boxes. How many horses do we need?

C In Picture G we need ▒ cows for the 3 boxes. How many sheep do we need?

D Ann put 2 chicken sandwiches and 3 peanut butter sandwiches into each picnic box. She needed 6 chicken sandwiches for all her boxes. How many boxes did she have? How many peanut butter sandwiches did she need? 6



E Mary put 5 carrot sticks and 4 cookies into each of her picnic boxes. She needed 10 carrot sticks for all her boxes. How many cookies did she need? 7

F Betty put 2 chocolates and 3 candy sticks into each bag. She needed 8 chocolates. How many candy sticks did she need? 7

Sometimes you must find out if each of two numbers can be divided by the same number. Sometimes you must multiply each of two numbers by the same number.

235

235

1 Tell the children that the 3 boxes show they are to make 3 sets like the animals shown [2 pandas, 3 bears].

2 Have the children select the groups of pandas and bears that will make 3 complete sets. They should choose the groups of 6 pandas and 9 bears.

3 Draw attention to the first scene and tell the children that the dogs and sheep in the picture make a set. Ask how many sets are to be made.

4 Have the children find the missing numbers in Exercise A. Let them use objects or make marks on their papers, if necessary.

5 Adapt Notes 3 and 4 to this picture and its text.

6 Be sure children can explain how they know that Ann had 3 picnic boxes. Let them use objects or make marks, if necessary, to find the number of peanut butter sandwiches.

7 Adapt Note 6 to this problem.

236 Using arithmetic; Keeping skillful

Expanded Notes are not considered necessary for these lessons.

Objectives

The child practices solving verbal problems of different kinds. He practices adding and subtracting numbers and checking answers. He reviews selected multiplication and division basic facts.

Vocabulary

There are no new words in these lessons.

Comments

The problems and maintenance exercises may be handled in the usual way. Allow the children to work independently.

Answers

Using arithmetic:

A $40+27+27=[94]$
B $7\times4=[28]$
C $24\div[3]=8$
D $\$.36+[\$.13]=\$.49$
E $\$.72-\$.25=[\$.47]$
F $[\$.90]+\$.35=\$1.25$
G $213-128=[85]$
H $25\div3=[8$ and 1 rm.$]$

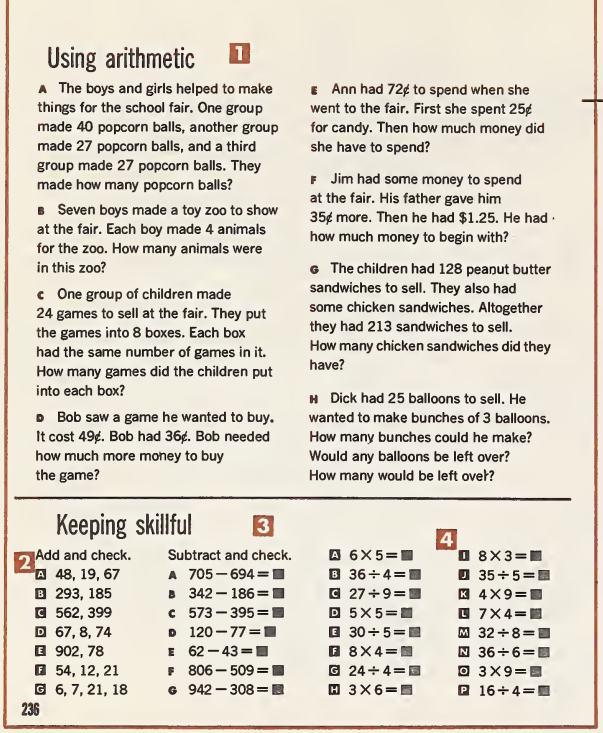
Keeping skillful:

(block 1)

A 134	C 961	E 980	G 52
B 478	D 149	F 87	

(block 2)

A 11	C 178	E 19	G 634
B 156	D 43	F 297	



Using arithmetic 1

A The boys and girls helped to make things for the school fair. One group made 40 popcorn balls, another group made 27 popcorn balls, and a third group made 27 popcorn balls. They made how many popcorn balls?

B Seven boys made a toy zoo to show at the fair. Each boy made 4 animals for the zoo. How many animals were in this zoo?

C One group of children made 24 games to sell at the fair. They put the games into 8 boxes. Each box had the same number of games in it. How many games did the children put into each box?

D Bob saw a game he wanted to buy. It cost 49¢. Bob had 36¢. Bob needed how much more money to buy the game?

E Ann had 72¢ to spend when she went to the fair. First she spent 25¢ for candy. Then how much money did she have to spend?

F Jim had some money to spend at the fair. His father gave him 35¢ more. Then he had $1.25. He had how much money to begin with?

G The children had 128 peanut butter sandwiches to sell. They also had some chicken sandwiches. Altogether they had 213 sandwiches to sell. How many chicken sandwiches did they have?

H Dick had 25 balloons to sell. He wanted to make bunches of 3 balloons. How many bunches could he make? Would any balloons be left over? How many would be left over?

Keeping skillful 3

2 Add and check.

A 48, 19, 67
B 293, 185
C 562, 399
D 67, 8, 74
E 902, 78
F 54, 12, 21
G 6, 7, 21, 18

Subtract and check.

A 705 − 694 = ■
B 342 − 186 = ■
C 573 − 395 = ■
D 120 − 77 = ■
E 62 − 43 = ■
F 806 − 509 = ■
G 942 − 308 = ■

4

A 6 × 5 = ■
B 36 ÷ 4 = ■
C 27 ÷ 9 = ■
D 5 × 5 = ■
E 30 ÷ 5 = ■
F 8 × 4 = ■
G 24 ÷ 4 = ■
H 3 × 6 = ■
I 8 × 3 = ■
J 35 ÷ 5 = ■
K 4 × 9 = ■
L 7 × 4 = ■
M 32 ÷ 8 = ■
N 36 ÷ 6 = ■
O 3 × 9 = ■
P 16 ÷ 4 = ■

236

236

1 Assign these problems as written work. Tell pupils that for each problem they are to write an equation that describes the situation, use a screen (or square) in place of the number to be found, and do any computation that is necessary. Then have them write the equation again with the answer substituted for the screen. Supply answers so that the children can verify their work.

2 For these examples tell pupils to write the numbers in computational form and follow directions. They may check their answers by adding again.

3 Have children write these examples in computational form and follow directions.

4 Use these exercises for oral response first. Then have pupils write each answer after its identifying letter.

237-240 Moving forward

Expanded Notes for this lesson are on pages 308-310.

Objectives

The child learns the meaning of fractions by taking part of one thing or part of a group. He learns how to read and write the numerals that stand for fractions through eighths.

Vocabulary

New words page 238 parts*, been*

Introduce the word *fraction* and use it orally throughout the lesson.

Comments

The work in this lesson builds on the knowledge children already have about fractions. It develops the idea of the unit fraction (a fraction with 1 for the numerator) and also that of the non-unit fraction (a fraction with a numerator larger than 1). It also applies the concept of a fraction to a group as well as to a unit (one thing). The written notation of fractions (through eighths) is developed, and children are helped to generalize about relative sizes of fractions.

This lesson introduces the child to the need for using two integers (whole numbers) to describe a rather complex situation. The concept of a fraction involves a combination of three ideas.

First, an object is divided into equal parts, or a group of objects is divided into equal subgroups.

Second, attention is focused on only some of these equal parts.

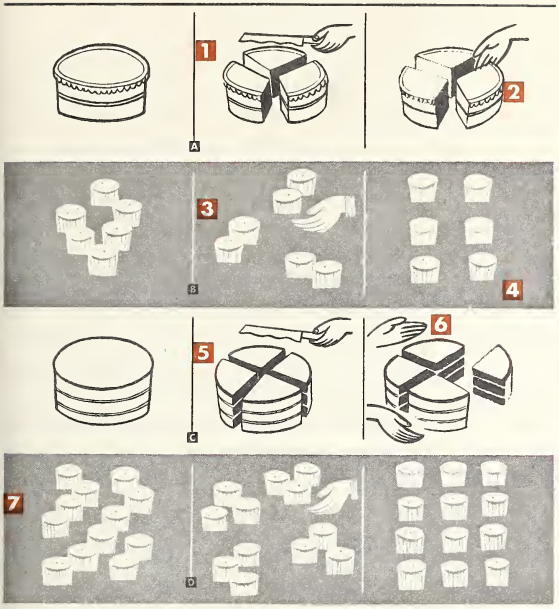
Third, the fraction idea involves the relationship between the amount taken and the original amount.

Many experiences with concrete situations are required before the pupil acquires this relatively abstract concept. This treatment is not intended to lead to "mastery" of the fraction concept, but only to produce readiness for a genuine understanding of fractions in later grades.

The terms *numerator* and *denominator* are not used in this book.

Moving forward

In this lesson you will learn about a new kind of numeral.



The 3 shows that the cake has been divided into 3 equal parts. ⟶ $\frac{1}{3}$ ⟵ The 1 shows we are thinking about 1 of the equal parts.

one third

The 3 shows that the cupcakes have been divided into 3 equal groups. ⟶ $\frac{1}{3}$ ⟵ The 1 shows we are thinking about 1 of the equal groups.

one third

4

The 4 shows that the cake has been divided into 4 equal parts. ⟶ $\frac{3}{4}$ ⟵ The 3 shows we are thinking about 3 of the equal parts.

three fourths

5

The 4 shows that the cupcakes have been divided into 4 equal groups. ⟶ $\frac{3}{4}$ ⟵ The 3 shows we are thinking about 3 of the equal groups.

three fourths

237

1. Draw attention to the fact that the whole cake in the first scene has just been cut into three equal pieces.
2. Let the pupils discover that the hand is taking one of the three equal pieces. Explain that this piece is one third of the cake.
3. Get the children to see that the six cupcakes in the first scene have been separated into three equal groups. Explain that each group is one third of all the cupcakes.
4. Direct attention to the undimmed group of cupcakes and get the children to observe that it is one third of all the cupcakes.
5. Let them discover that the cake has been divided into four equal parts.
6. Get the children to notice that the hands are removing three of the equal parts. Tell them that three fourths of the cake are being removed.
7. Use similar procedure for Movie D.

238

1. Direct attention to the cake cut in 3 equal parts and have children observe that the undimmed piece is one third of the whole cake.
2. Tell the children to look at the large $\frac{1}{3}$. Relate the 3 to the number of equal parts of the cake in the picture and the 1 to the number of parts we are thinking of (the undimmed piece).
3. Have the children look at the picture and get them to observe that the undimmed cupcakes are one third of the entire group. Relate the numeral ($\frac{1}{3}$) to the picture, as was done for Movie E.
4. Adapt Notes 1 and 2 to this picture and its text. Be sure the children are aware that here they are paying attention to three of the four equal parts.
5. Adapt Note 3 to this picture and its text. Be sure the children relate the 3 of the fraction to the three undimmed groups of cupcakes in the picture.

A The white cake in Picture A has been divided into ▪ equal parts.
Each part is one half of the cake.
Each part is $\frac{1}{2}$ of the cake.

B The 15 cookies in Picture B have been divided into ▪ equal groups. **2**

C The 15 cookies are divided into fifths.
Each package of cookies is ▪ fifth, or $\frac{1}{5}$, of all the cookies.

D Three packages of cookies are ▪ fifths, or $\frac{3}{5}$, of all the cookies.

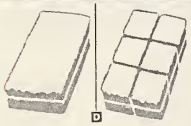
E Four packages of cookies are $\frac{4}{5}$ of all the cookies.

F The 16 cupcakes in Picture C have been divided into ▪ equal groups. **3**

G The 16 cupcakes are divided into eighths.
Each package of cupcakes is $\frac{1}{8}$ of all the cupcakes.

H Four packages of cupcakes are $\frac{4}{8}$ of all the cupcakes.

I Seven packages of cupcakes are $\frac{7}{8}$ of all the cupcakes.

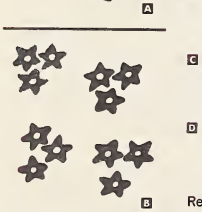


J The chocolate cake in Picture D has been divided into ▪ equal parts. **4**

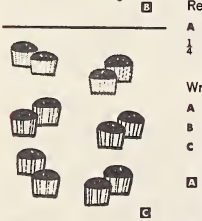
K Each part is $\frac{1}{8}$ of the cake.

L Five parts are $\frac{5}{8}$ of the cake.

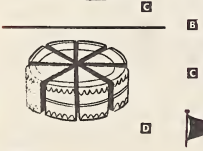
A The cake in Picture A is divided into ▪ equal pieces.
The cake is divided into ▬.
Jim is going to eat 2 eighths of the cake. **1**
He is going to eat $\frac{2}{8}$ of the cake.



B The cookies in Picture B are divided into ▬
Mary is going to buy 3 fourths of them. **2**
She is going to buy $\frac{3}{4}$ of the cookies.



C The cupcakes in Picture C are divided into ▬.
Ann is going to buy 4 sixths of them. **2**
She is going to buy $\frac{4}{6}$ of the cupcakes.



D The cake in Picture D is divided into ▬
The children are going to eat 7 eighths of it. **2**
They are going to eat $\frac{7}{8}$ of the cake.

Read. **3**

A	B	C	D	E	F	G	H	I	J	K	L	M
$\frac{1}{4}$	$\frac{2}{5}$	$\frac{5}{8}$	$\frac{2}{6}$	$\frac{3}{7}$	$\frac{6}{8}$	$\frac{1}{5}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{4}{5}$	$\frac{1}{2}$	$\frac{5}{7}$	$\frac{3}{6}$

Write the numerals. **4**

A one half	D three fifths	G one third
B two thirds	E one fourth	H two sevenths
C four eighths	F five sixths	I two fourths

A Which is more, one half of a cake or one third of the same cake? **5**

B Which is more, one third of a dozen cookies or one fourth of a dozen cookies?

C Which is more, two thirds of a cake or three fourths of the same cake?

You should know what numerals to use for parts of things or parts of groups.

239

1 Direct attention to the picture and have the accompanying text read. Relate the 2 in $\frac{1}{2}$ to the number of parts into which the cake has been cut and the 1 to one of these pieces.

2 Let the children read these exercises (B to E) and refer to Picture B to find the missing numbers. Be sure they understand that 5 in the fractions stands for the number of groups into which the objects have been divided and the 1, 3, and 4 stand for the number of these groups that are of interest at the moment.

3 Adapt Note 2 to these exercises (F to I) and their accompanying picture.

4 Adapt Note 2 to these exercises (J to L) and their accompanying picture.

240

1 Have this text read. Tell pupils to use Picture A to find the answers. Explain that the undimmed pieces are the ones Jim is going to eat.

2 Adapt Note 1 to this text and its picture.

3 Let the children take turns reading these fractions.

4 The children should write the numerals for these fractions on their papers.

5 If some children have trouble making these comparisons, draw pictures of cakes and cookies on the board, dividing them into halves, thirds, and fourths, as called for in the exercises. The children may also do this, if you wish.

241 Using arithmetic; Thinking straight

Expanded Notes are not considered necessary for these lessons.

Objectives

The child solves verbal problems. He learns to use judgment in determining relative sizes of fractions.

Vocabulary

There are no new words in these lessons.

Comments

Treat the verbal problems as written work in the usual way.

The "Thinking straight" exercises give the child an opportunity to show how well he understands concepts of relative sizes of fractions. Exercises A to D involve putting fractions having the same denominators but different numerators in order of increasing size. Exercises E to H involve putting fractions having the same numerators but different denominators in order of increasing size. Exercises I to P involve arranging, in order of increasing size, fractions which may be unlike in both numerators and denominators. Go through one series of each type orally to make sure that pupils understand what to do.

Answers

Using arithmetic:

A $9+9=[18]$
B $11-6=[5]$
C $36\div[9]=4$
D $28-19=[9]$
E $12\div4=[3]$
F $[9]+8=17$
G $32-15=[17]$
H $3\times7=[21]$
I $27-19=[8]$

Thinking straight:

A $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}$
B $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$
C $\frac{1}{6}, \frac{2}{6}, \frac{3}{6}, \frac{4}{6}, \frac{5}{6}$
D $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \frac{6}{7}$
E $\frac{1}{8}, \frac{1}{7}, \frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}$
F $\frac{3}{8}, \frac{3}{7}, \frac{3}{6}, \frac{3}{5}, \frac{3}{4}$
G $\frac{2}{8}, \frac{2}{6}, \frac{2}{5}, \frac{2}{4}, \frac{2}{3}$
H $\frac{4}{8}, \frac{4}{7}, \frac{4}{6}, \frac{4}{5}$
I $\frac{1}{2}, \frac{2}{3}, \frac{5}{6}, \frac{7}{8}$
J $\frac{1}{5}, \frac{1}{3}, \frac{3}{4}, \frac{5}{6}$
K $\frac{1}{8}, \frac{1}{4}, \frac{3}{4}, \frac{7}{8}$
L $\frac{1}{7}, \frac{2}{6}, \frac{4}{7}, \frac{4}{6}$
M $\frac{1}{6}, \frac{2}{3}, \frac{7}{8}$
N $\frac{1}{5}, \frac{2}{3}, \frac{3}{4}$
O $\frac{1}{3}, \frac{1}{2}, \frac{4}{5}$
P $\frac{1}{4}, \frac{2}{5}, \frac{5}{8}$

Using arithmetic 1

A At the playground 2 teams of boys played a baseball game. There were 9 boys on one team and 9 boys on the other team. How many boys played in the baseball game?

B Don had eleven marbles. He gave six of them to Jim so that they could play a game. How many marbles did Don keep?

C Four friends on the playground shared 36 jacks equally. How many jacks did each one get?

D In a basketball game, Jim made 28 points, and Don made 19 points. Jim made how many more points in the game than Don?

E 12 girls divided into equal teams for a game. 4 girls were on each team. How many teams were there?

F Ann saw some birds on the fence. Eight more birds flew to the fence. Then she counted 17 birds on the fence. How many birds were on the fence to begin with?

G June took a book to the playground to read to her little sister. The book had 32 pages in it. June read 15 pages in the morning and the rest in the afternoon. How many pages did she read in the afternoon?

H Three groups of girls were playing jacks. There were 7 girls in each group. How many girls were playing jacks?

I 27 boys were on the playground on one day. The next day 19 boys were there. How many more boys were on the playground on the first day than on the second day?

Thinking straight

Write these so that the smallest one is first, the next to the smallest is second, the third smallest is next, and so on.

A $\frac{3}{8}, \frac{6}{8}, \frac{1}{8}, \frac{5}{8}, \frac{8}{8}, \frac{7}{8}, \frac{2}{8}$
B $\frac{2}{5}, \frac{4}{5}, \frac{1}{5}, \frac{3}{5}$
C $\frac{2}{6}, \frac{4}{6}, \frac{5}{6}, \frac{3}{6}, \frac{1}{6}$
D $\frac{5}{7}, \frac{1}{7}, \frac{4}{7}, \frac{3}{7}, \frac{6}{7}, \frac{2}{7}$
E $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{3}, \frac{1}{7}, \frac{1}{8}, \frac{1}{5}$
F $\frac{3}{8}, \frac{3}{4}, \frac{3}{8}, \frac{3}{7}, \frac{3}{8}$
G $\frac{2}{8}, \frac{2}{6}, \frac{2}{5}, \frac{2}{8}, \frac{2}{8}$
H $\frac{4}{8}, \frac{4}{5}, \frac{4}{7}, \frac{4}{8}$
I $\frac{7}{8}, \frac{5}{8}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}$
J $\frac{1}{3}, \frac{3}{4}, \frac{5}{6}, \frac{1}{5}$
K $\frac{1}{8}, \frac{1}{8}, \frac{7}{8}, \frac{3}{4}$
L $\frac{2}{6}, \frac{4}{6}, \frac{1}{7}, \frac{4}{7}$
M $\frac{1}{6}, \frac{7}{8}, \frac{2}{3}$
N $\frac{3}{4}, \frac{2}{3}, \frac{1}{5}$
O $\frac{4}{5}, \frac{1}{3}, \frac{1}{2}$
P $\frac{2}{5}, \frac{1}{4}, \frac{5}{8}$

3

241

241

1 Assign Problems A to I as written work. When all pupils have finished, provide answers so that they can verify their equations and computation.

2 Discuss Exercises A, E, and I orally. Then assign the entire set as written work. Tell the children that they may draw circles and squares and divide them into parts to help find the right answers. Encourage discussion about how they made their decisions.

3 Exercises I to P require judgment. Answers should be based strictly on what the children have already learned from pictures and exercises.

242 Side trip

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to identify circles, squares, and triangles.

Vocabulary

New words page 242 like*, circle, square, triangle

Comments

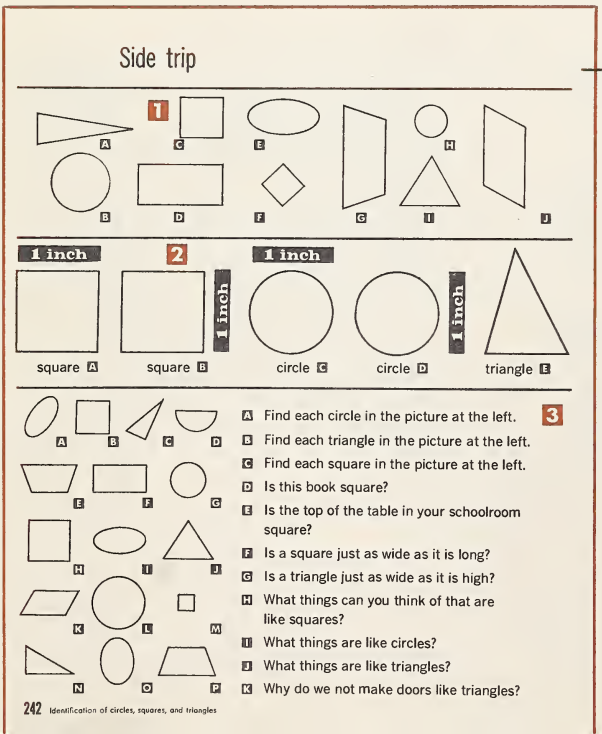
In this lesson children are introduced to various types of plane figures. Through oral discussion and observation they learn several distinguishing features: squares have four sides all of the same length and have square corners; not all squares are the same size; some figures have four sides, but they are not squares because the sides are not the same length and the corners are not square; triangles have three sides, but the sides do not all have to be the same length; triangles are of different sizes; points on the line that is a circle are all the same distance from a point within, called the center; the distance across a circle, passing through the center, is always the same, no matter where it is measured.

Figures A and B (center strip) help the children observe that the sides of a square are equal. If the 1-inch sticks used with the measuring lessons on pages 86 and 87 are available, have the children use them to measure all the sides of the square. Similarly, for Circles C and D have pupils measure across the circle through the center in many different ways to discover that the distance is always the same.

Questions A to K will give children practice in distinguishing various plane figures and in becoming aware of their use in everyday life.

As a concluding activity, you might ask children to name things that are shaped like circles, squares, and triangles: table tops, wheels, rhythm triangles, etc. You could also have some objects on hand for the children to identify by shape.

Activity 28, page 325, may be used with this lesson.


Side trip
1
A
C
E
H
B
D
F
G
I
J
1 inch
2
1 inch
1 inch
1 inch
square A
square B
circle C
circle D
triangle E
3
A Find each circle in the picture at the left.
B Find each triangle in the picture at the left.
C Find each square in the picture at the left.
D Is this book square?
E Is the top of the table in your schoolroom square?
F Is a square just as wide as it is long?
G Is a triangle just as wide as it is high?
H What things can you think of that are like squares?
I What things are like circles?
J What things are like triangles?
K Why do we not make doors like triangles?
242 Identification of circles, squares, and triangles

242

1 Have children observe and discuss differences among these figures.

2 Children may use 1-inch measuring sticks to discover that all sides of the square are the same length. Then let them measure the width of the circle through the center. Make sure they discover that it is always the same whether they place the measuring sticks vertically, horizontally, or in any number of ways. Have them observe that the triangle has three sides, and that these sides do not need to be of equal length. Have them note the names of these three types of figures.

3 Pupils may answer these exercises orally first. Then have them write the letters A to K on their papers and write each answer beside its identifying letter.

243 Thinking straight; Keeping skillful

Exponded Notes ore not considered necessary for these lessons.

Objectives

The child learns to recognize halves and fourths in squares, circles, and triangles. He practices finding the sums and differences of two-figure and three-figure numbers and reviews some multiplication and division basic facts.

Vocabulary

There are no new words in these lessons.

Comments

These exercises are designed to give children experience in selecting halves and fourths of squares, circles, and triangles from figures that are divided into two or four parts, and to reject those not so divided. Pupils learn that a figure is divided into halves and fourths only when the parts are equal. They also learn that the equal parts do not need to be the same shape; for example, see Exercises S and T. After this exercise has been finished, some of the children might draw circles and squares and show ways of dividing them into thirds. The slower learners can draw circles and squares, and, without the aid of the book, show ways of dividing them into halves and fourths. Let the children exhibit their drawings afterwards. Encourage them to discover ways of dividing that are not suggested in the book.

The "Keeping skillful" exercises should be assigned as written work.

Answers

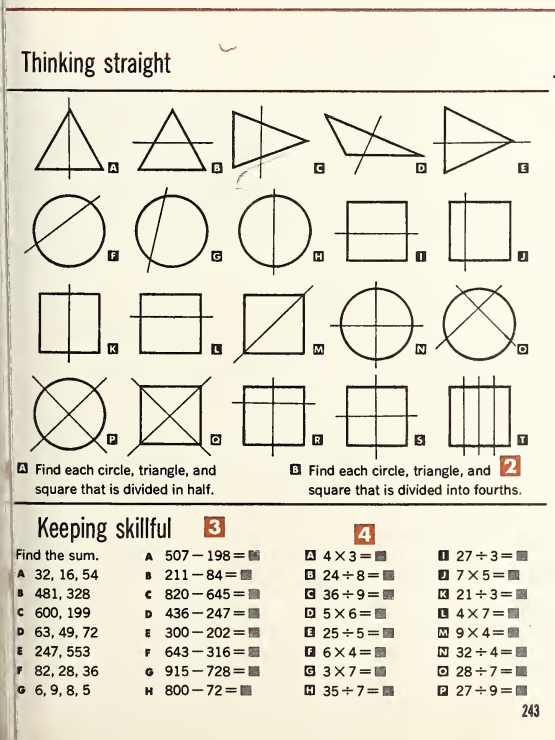
Thinking straight:

A [A, E, H, I, K, M] B [N, P, Q, S, T]

Note: There might be some question in the children's minds about Figures E and I. Let them justify their decisions. In T the red line is not divided into fourths, but the space inside it is.

Keeping skillful:

(block 1)		(block 2)	
A 102	E 800	A 309	E 98
B 809	F 146	B 127	F 327
C 799	G 28	C 175	G 187
D 184		D 189	H 728



243

1 Ask children to examine the figures. Call on various pupils to name the letter of a figure that shows a circle divided into halves, a square divided into halves, a triangle divided into halves. Then have them write on their papers the letter of each figure that is divided into halves.

2 Have pupils read these directions. Give them time to look over the figures. Then call on pupils to name the letter of a circle divided into fourths, a square divided into fourths. Ask if there are any triangles divided into fourths. Tell pupils to write the letter of each figure that is divided into fourths. Have them see that a given figure can be cut into fourths, thirds, etc., in many ways.

3 For each example have the children compute, then write the answer after its identifying letter.

4 Pupils may write the letters A to P on their papers and write the answer after each.

244-245 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving verbal problems.

Vocabulary

New words page 244 library

Comments

Assign these problems as written work. The children should work independently in writing equations and computing to find the answers.

Use the examples in "Keeping skillful" as a separate activity. Assign only as many of these examples as you are sure the class can complete in the time available.

Answers

Pages 244-245:

A $47+64+21=[132]$

B $15+22=[37]$ or $22+15=[37]$

C $17-12=[5]$

D $12\div 4=[3]$

E $[7]+5=12$

F $271-68=[203]$

G $9\times 3=[27]$

H $35+[25]=60$

I $126-48=[78]$

J $18\div[3]=6$

K $3\times 2=[6]$

L $248-157=[91]$

M $4\times 8=[32]$

N $5\times 3=[15]$

O $318+287=[605]$ or $287+318=[605]$

P $318-164=[154]$

Q $34+[18]=52$

R $21\div[3]=7$

S $126+84+140=[350]$

T $6\times 5=[30]$

Keeping skillful:

(block 1)

A 18	F 85	J 823	N 39
B 124	G 79	K 122	O 102
C 53	H 16	L 100	P 959
D 301	I 95	M 343	Q 153
E 115			

(block 2)

A 335	F 49	J 162	N 323
B 28	G 226	K 69	O 165
C 39	H 449	L 14	P 811
D 60	I 248	M 358	Q 935
E 331			

Using arithmetic 1

A Sometimes the boys and girls help in the school library. One day they counted 47 books on one shelf, 64 on another shelf, and 21 on a third shelf. The children counted how many books in all?

B The boys opened two boxes of books. There were 15 books in one box and 22 books in the other box. How many books were in the boxes that the boys opened?

C Ann emptied a box that had 17 new books in it. Ellen emptied a box that had 12 new books in it. The box that Ellen emptied had how many fewer books in it than the box that Ann emptied?

D Ellen put the 12 new library books in equal piles, with 4 books in each pile. How many piles of books did she make?

E Some chairs were at a table. Jim put 5 more chairs at the table. Then there were 12 chairs. How many chairs were at the table at first?

F In the library there were 271 books about different kinds of animals. 68 books were about dogs. How many books were about other kinds of animals?

G Each of 9 boys took 3 books down from a shelf. How many books in all did the boys take down?

H 35 children were in the library for the story hour. More children came in. Then there were 60 children. How many children came in?

I Carol said, "My library book has 126 pages in it. I have read 48 pages." How many pages were left in the book for Carol to read?

J Six boys took out 18 books. Each boy took out the same number of books. Each boy took out how many books?

K Tom, Bob, and Bill took out 2 books each. How many books in all did the boys take out?

L Children took out 248 library books on Monday and 157 on Tuesday. They took out how many more library books on Monday than on Tuesday?

M In the library there were 4 long tables. Eight children were looking at books at each table. How many children were looking at books at the tables?

N Each of 5 boys found 3 books about horses. They found how many books in all about horses?

244

244

1 Tell the children to write an equation for each of these problems (A to T) and use a screen (or square) in place of the missing number. Then they should compute and rewrite the equation with the missing number in place of the screen.

O The library cards were in two boxes. There were 318 cards in one box and 287 cards in another box. How many library cards were in the two boxes?

P The box with 318 cards had 164 yellow cards. The others were white. How many of these cards were white?

Q On Monday there were 34 new books in the library. Some more were added on Tuesday. Then there were 52 new books in the library. How many new books were added on Tuesday?

R Seven girls took home 21 books about games. Each girl took home the same number of books. How many books did each girl take home?

S Carol took 3 books home. One book had 126 pages, another book had 84 pages, and the third book had 140 pages. How many pages in all were in these 3 books?

T The school library is open 5 days a week. How many days is it open in 6 weeks?

1

Keeping skillful

2 3 4 4

A 82 + ■ = 100	A 801 − 466 = ■	A 4 × 5 = ■	A 5 × 6 = ■
B 75 + 49 = ■	B 123 − 95 = ■	B 32 ÷ 8 = ■	B 25 ÷ 5 = ■
C ■ + 21 = 74	C 526 − 487 = ■	C 24 ÷ 3 = ■	C 28 ÷ 7 = ■
D 236 + 65 = ■	D 320 − 260 = ■	D 7 × 4 = ■	D 7 × 3 = ■
E 98 + 17 = ■	E 715 − 384 = ■	E 3 × 9 = ■	E 4 × 6 = ■
F 175 + ■ = 260	F 241 − 192 = ■	F 36 ÷ 6 = ■	F 36 ÷ 4 = ■
G 38 + 41 = ■	G 493 − 267 = ■	G 7 × 5 = ■	G 27 ÷ 9 = ■
H 57 + ■ = 73	H 630 − 181 = ■	H 4 × 8 = ■	H 5 × 4 = ■
I 66 + 29 = ■	I 915 − 667 = ■	I 24 ÷ 4 = ■	I 28 ÷ 4 = ■
J 743 + 80 = ■	J 214 − 52 = ■	J 21 ÷ 3 = ■	J 35 ÷ 5 = ■
K ■ + 39 = 161	K 500 − 431 = ■	K 9 × 4 = ■	K 8 × 3 = ■
L 43 + 57 = ■	L 110 − 96 = ■	L 6 × 6 = ■	L 21 ÷ 7 = ■
M 54 + 289 = ■	M 884 − 526 = ■	M 16 ÷ 4 = ■	M 24 ÷ 3 = ■
N 25 + ■ = 64	N 421 − 98 = ■	N 7 × 2 = ■	N 9 × 2 = ■
O 77 + 25 = ■	O 300 − 135 = ■	O 32 ÷ 4 = ■	O 20 ÷ 5 = ■
P 430 + 529 = ■	P 937 − 126 = ■	P 2 × 6 = ■	P 6 × 4 = ■
Q ■ + 247 = 400	Q 978 − 43 = ■	Q 5 × 5 = ■	Q 30 ÷ 6 = ■

245

245

1 When the children have finished these problems, supply answers so that they can verify their work. If any problems have been especially difficult, discuss them with the class.

2 Tell the children to compute in each example and write the answer opposite its identifying letter.

3 Proceed in a similar way with these examples.

4 Children may write only the answers opposite their identifying letters, or they may write the equations, supplying the missing numbers.

246-249 Looking back

Expanded Notes are not considered necessary for these lessons.

Objectives

The child reviews the basic concepts underlying the four processes, the number system, money, and measures.

Vocabulary

There are no new words in these lessons.

Comments

Every child should have an opportunity to respond to every exercise. Examine each child's work to discover what reteaching may be necessary.

Reteaching guide

The pages listed in the table below indicate where to turn in this book for reteaching material.

Page 246:

Exercise	Page	Exercise	Page
A	3	D	19
B	8	E	156
C	17	F	4
G	9	K	28
H	20	L	28
I	18	M	9
J	4	N	4, 52, 148

Page 247:

Exercise	Page
Block 1	140, 142
Block 2	141, 143

Page 248:

Exercise	Page
Block 1	148-149
Block 2	151
Block 3	56-58

Page 249:

(block 1)

Exercise	Page	Exercise	Page
A-E	86-87	G-H	216
F	87	I-L	87

(block 2)

Exercise	Page	Exercise	Page
A	214	D	214
B	87	E	214
C	216	F	90, 128-129

G	215	M	71, 214
H	129	N	87, 129
I	90, 128-129	O	87
J	214	P	128-129
K	214	Q	87, 129
L	214	R	128-129

Answers

Page 246:

A [B]	D [A]	G [C]	J [B]	M [C]
B [C]	E [B]	H [A]	K [D]	N =, $, ¢
C [D]	F [B]	I [D]	L [A]	

Page 247:

(block 1)

A [C]	C [A]	E [D]	G [A]
B [B]	D [D]	F [C]	H 7

(block 2)

A 3005	E 7965	I 5754	M 6011	Q 1010
B 1247	F 7120	J 510	N 9003	R 110
C 2421	G 4240	K 436	O 824	
D 928	H 9780	L 117	P 8050	

Page 248:

(block 1)

A $7.88 B $16.80 C $2.18 D $6.50

(block 2)

A 4 nickels	D 2 dimes	G 10 pennies
B 2 quarters	E 4 dimes	H 8 nickels
C 5 dimes	F 10 nickels	

Page 249:

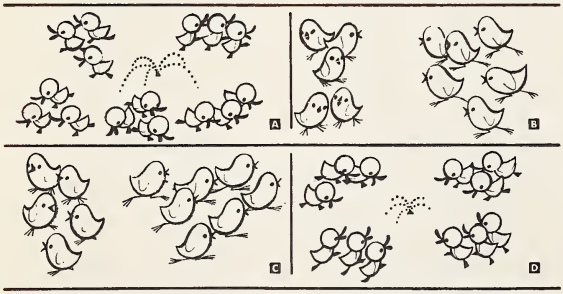
(block 1)

A 2; Lines 3,6	F 19 inches	J 23 inches
B 2 inches	G more than	K 16 inches
C 3 inches	H 18 ounces	L 63 inches
D 3; Lines 1,2,5	I 9 inches	

(block 2)

A 60 seconds	G 12 things	M 3 weeks
B 12 inches	H 5 yards	N 3 yards
C 16 ounces	I 32 pints	O 36 inches
D 4 weeks	J 14 days	P 18 pints
E 60 minutes	K 24 hours	Q 15 feet
F 4 gallons	L 12 months	R 7 quarts

Looking back



1

A Which picture shows one group coming together with another group?

B Which picture shows a group separating from a larger group?

C Which picture shows equal groups coming together?

D Which picture shows a group separating into smaller equal groups?

E In which picture would you find the sum?

F With which picture would you use "plus"?

G With which picture would you use "minus"?

H With which picture would you use "divided by"?

I With which picture would you use "multiplied by"?

J With which picture would you use the sign +?

K With which picture would you use the sign ×?

L With which picture would you use the sign ÷?

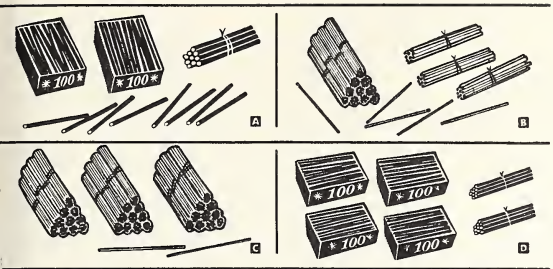
M With which picture would you use the sign −?

N What other signs have you used in your work this year?

246

1 Children should work independently on these exercises, writing each answer opposite its identifying letter. If examination of their answers indicates weaknesses, reteach as necessary. (See table in "Reteaching Guide" for help in finding reteaching material.)

Looking back



A Which picture shows the number 302?
B Which picture shows the number 135?
C Which picture shows the number 218?
D Which picture shows the number 420?
E In which picture is the numeral 2 in tens' place?

1

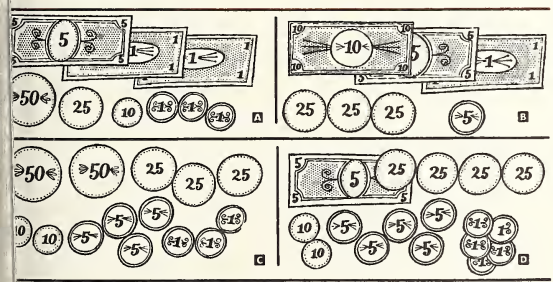
F In which picture is the numeral 2 in ones' place?
G In which picture is the numeral 2 in hundreds' place?
H In the number 7356, what numeral is in thousands' place?

Write with numerals.

1

A three thousand five
B one thousand two hundred forty-seven
C two thousand four hundred twenty-one
D nine hundred twenty-eight
E seven thousand nine hundred sixty-five
F seven thousand one hundred twenty
G four thousand two hundred forty
H nine thousand seven hundred eighty
I five thousand seven hundred fifty-four
J five hundred ten
K four hundred thirty-six
L one hundred seventeen
M six thousand eleven
N nine thousand three
O eight hundred twenty-four
P eight thousand fifty
Q one thousand ten
R one hundred ten

Looking back



A What amount of money is shown in Picture A?
B What amount of money is shown in Picture B?
C What amount of money is shown in Picture C?
D What amount of money is shown in Picture D?

A 1 half dollar = 3 dimes ■ nickels
B 1 dollar = ■ quarters 5 dimes
C 1 dollar = 1 half dollar ■ dimes
D 1 quarter = ■ dimes 5 pennies
E 1 half dollar = ■ dimes 10 pennies
F 1 dollar = 2 quarters ■ nickels
G 1 quarter = 3 nickels ■ pennies
H 1 half dollar = ■ nickels 10 pennies

3

For each of these problems, draw the coins that you would use in making change. Under each coin write the number you would say as you make the change.

A June bought a dollhouse for $1.69. She gave the man $2.00.
B Jim gave the man a half dollar for some crayons that cost $.27.
C Bill gave the man 2 quarters for a ball that cost 39¢.
D Ann bought some flowers for $.76. She gave the man 2 half dollars.
E June gave the man $3.00 for a doll bed that cost $2.85.

247

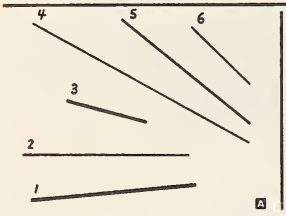
1 Children should write each answer opposite its identifying letter. (See table in "Reteaching Guide" for reteaching material, if such reteaching proves to be necessary.)

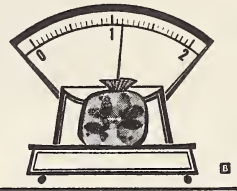
248

1 Tell children to write each amount of money opposite the letter of the exercise.
2 Have children write each missing number opposite its identifying letter.
3 Children should read the directions and then do the work asked for. They should work independently.

(See table in "Reteaching Guide" for reteaching material for this page.)

Looking back





1

A How many lines in Picture A are 1 inch long?

B How long is Line 5?

C How long is Line 4?

D How many lines in Picture A are 2 inches long?

E On your paper draw a line that you think is 4 inches long. Measure your line. Is your drawing correct?

2

E A line is 1 foot 7 inches long. It is how many inches long?

2

G Does the package in Picture B weigh more than or less than 1 pound?

H The package weighs ■ ounces.

I A garden fence is 21 inches high. It is ■ inches more than a foot high.

J Another fence is 1 foot 11 inches high. This fence is ■ inches high.

K A table is 52 inches long. It is ■ inches more than 1 yard long.

L Another table is 1 yard 27 inches long. This table is ■ inches long.

3

A 1 minute = ■ seconds
B ■ inches = 1 foot
C ■ ounces = 1 pound
D 28 days = ■ weeks
E ■ minutes = 1 hour
F 16 quarts = ■ gallons
G 1 dozen = ■ things
H 15 feet = ■ yards
I 4 gallons = ■ pints
J 2 weeks = ■ days
K ■ hours = 1 day
L 1 year = ■ months
M ■ weeks = 21 days
N 9 feet = ■ yards
O ■ inches = 1 yard
P 9 quarts = ■ pints
Q ■ feet = 5 yards
R 14 pints = ■ quarts

249

1 Tell children that they may use their rulers to answer Exercises A to E. They should write the answers after the identifying letters.

2 Children should work independently on Exercises F to L and write each answer opposite its identifying letter.

3 Some of these are recall items; others require computation. Have children write the answer for each exercise opposite its letter.

(See table in "Reteaching Guide" for reteaching material for this page.)

250 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his ability to recognize and solve eight types of problem situations presented in this book.

Vocabulary

There are no new words in this lesson.

Comments

Each of these two problem-solving tests covers the eight types of problem situations studied in this book. Basic facts only are used so as to test the ability to solve problems and not the ability to compute. It is suggested that the tests be given one at a time, with discussion and any reteaching that may be necessary intervening between the two tests.

Reteaching guide

The pages listed in the next column show you where to turn for reteaching material. Dividing the children into groups may help facilitate reteaching.

Test 1

Problem	Page	Problem	Page
A	37	E	193
B	37	F	134-136
C	39	G	75-76
D	72	H	39

Test 2

Problem	Page	Problem	Page
A	39	E	193
B	134-136	F	72
C	37	G	37
D	39	H	75-76

Answers

Test 1

A 4+6=[10]
B 12−5=[7]
C 2×9=[18]
D 11−7=[4]
E [4]+5=9
F 20÷[5]=4
G 7+[9]=16
H 36÷9=[4]

Test 2

A 3×7=[21]
B 15÷[3]=5
C 17−8=[9]
D 27÷9=[3]
E [9]+4=13
F 18−9=[9]
G 4+7=[11]
7+4=[11]
H 8+[8]=16

Checking up

Test 1 **1**

A Four girls were playing jacks. Six more girls came to play. Then how many girls were playing jacks?

B Twelve children were drawing a big circle on the ground to play a new game. Five of them went away. How many children were left?

C Two teams of boys were playing ball. There were 9 boys on each team. How many boys were playing ball?

D Eleven boys had red caps. Seven boys had yellow caps. How many more boys had red caps than yellow caps?

E Some boys were playing with tops. Five more boys came to play. Then 9 boys were playing with tops. How many boys were playing with tops to begin with?

F Twenty girls were playing a game. They were in 4 equal teams. How many girls were in each team?

G Jim had 7 stones at home. He picked up more stones on the playground. Then he had 16 stones. How many stones did he pick up on the playground?

H Some boys shared 36 marbles equally. Each boy got 9 marbles. How many boys shared the marbles?

} Achievement tests on problem types taught in this book

Test 2 **2**

A Three groups of children were marching in circles. There were 7 children in each circle. How many children were marching in circles?

B Five girls took 15 sandwiches to the playground and shared them equally. How many sandwiches did each girl get?

C 17 boys were playing ball. 8 boys went home. How many boys were left to play ball?

D Some of the girls on the playground were playing with 27 jacks. Each girl had 9 jacks. How many girls were playing jacks?

E Tom had some baseball cards. Bill gave him 4 more. Then Tom had 13 baseball cards. How many baseball cards did Tom have at first?

F Jim had 18 red marbles and 9 yellow marbles. He had how many fewer yellow marbles than red marbles?

G Carol picked up 4 stones on one day and 7 stones on another day. How many stones did she pick up on the 2 days?

H Ann had 8 cents. She earned some more money. Then she had 16 cents. How much money did she earn?

250

1 Tell the children to read each problem and write the equation that fits the problem situation, using a screen (or square) for the missing number. They then should decide on the answer and rewrite the equation, supplying the missing number.

2 Use Note 1 for this test also.

(See table in "Reteaching Guide" for reteaching material for these problems.)

251 Checking up

xpanded Notes are not considered necessary for this lesson.

bjectives

he child tests his knowledge of the basic facts for all ur processes, addition and subtraction computation ith two-figure and three-figure numbers, addition and btraction of money, and various types of equations.

ocabulary

here are no new words in this lesson.

mments

ese seven tests should be used diagnostically to reveal e extent of the child's knowledge of the basic facts ught in this grade and his competence in computa-n. These are power tests, not speed tests, so give only many of them in one period as you can reasonably pect your class to complete successfully.

Test 1 is on mixed basic facts in the four processes d covers sums and minuends to 18 and products and vidends to 36.

Test 2 is on the two types of division equations taught in this grade. The work is confined to basic facts.

Test 3 covers all the types of equations taught in this book. The work is restricted to the basic facts.

Test 4 is on addition of three or more one-figure numbers and on two or more two-figure and three-figure numbers.

Test 5 tests subtraction of numbers of two and three figures.

Test 6 covers addition and subtraction of money.

Test 7 tests the child's ability to use larger numbers in the three types of addition equations taught in this book.

There is much more to be gained from the administration of these tests than finding out whether or not the child gets the correct answers. The wise teacher will note the work habits of the children and the procedures they use in getting their answers. A quiet excursion around the room during which you make such observations will pay great dividends. Some of the things you

should watch for are: the speed and assurance the child has in his work, evidence of frustration and hesitation, resorting to procedures such as counting on fingers or making marks on paper, erasures that indicate faulty knowledge of basic facts or complete change of mind about the procedure. All of these should be noted and used in planning remedial work and further instruction. Reteaching materials are listed in the table below. Note that all reteaching can be done from this book.

Reteaching guide

Test 1

Example	Page	Example	Page
A	79-80	I	120-121
B	115-116	J	110
C,F,M	220-224	K	122-123
D	111	L	68-69
E,H,N	225-229	O	80-82
G	104		

Test 2

Example	Page	Example	Page
A,L	225-229	F	107
B,C,E,H,I,K,M,O	134-138	G,J	202-205
D	122-123	N	112

Test 3

Example	Page	Example	Page
A	112	F	105-106
B,N	225-229	G	110
C,K	75-78	I,M	193-196
D,O	220-224	J	80-82
E,H	134-138	L	107

Test 4

Example	Page	Example	Page
A,E,G,J,N	160-163	C,F,H,K,L,O	164-169
B,D,I,M	156-159		

Test 5

Example	Page	Example	Page
A-E,G,H,J,L,N	180-186	F,I,K,M	176-179

Test 6

Example	Page	Example	Page
A,D,E,G,H,K,N	170-172	B,C,F,I,J,L,M	187-189

Test 7

Example	Page	Example	Page
A,E,I,L	193-196	C,F,K,M	160-163
B,H	164-169	D,G,J,N	75-78

Answers

Test 4

A 109	D 18	G 100	J 125	M 26
B 18	E 130	H 599	K 761	N 152
C 825	F 950	I 21	L 891	O 902

Test 5

A 403	D 39	G 307	J 146	M 17
B 100	E 174	H 48	K 18	N 272
C 524	F 24	I 17	L 547	

Test 6

A $1.00	D $3.02	G $.96	J $1.63	M $4.38
B $3.08	E $7.70	H $9.51	K $7.00	N $1.00
C $1.65	F $.69	I $.09	L $6.08	

Test 7

A 21	D 109	G 185	J 322	M 51
B 846	E 525	H 891	K 143	N 17
C 150	F 69	I 35	L 59	

Checking up

Test 1 1

A 8 + 9 = ■
B 16 − 7 = ■
C 4 × 8 = ■
D 15 − 9 = ■
E 36 ÷ 6 = ■
F 7 × 5 = ■
G 9 + 5 = ■
H 28 ÷ 4 = ■
I 6 × 3 = ■
J 7 + 8 = ■
K 18 ÷ 6 = ■
L 11 − 5 = ■
M 4 × 9 = ■
N 27 ÷ 3 = ■
O 13 − 8 = ■

Test 2 1

A 36 ÷ 4 = ■
B 15 ÷ ■ = 3
C 27 ÷ ■ = 9
D 18 ÷ 6 = ■
E 25 ÷ ■ = 5
F 14 ÷ 7 = ■
G 24 ÷ 6 = ■
H 18 ÷ ■ = 9
I 21 ÷ ■ = 3
J 24 ÷ 8 = ■
K 30 ÷ ■ = 6
L 32 ÷ 4 = ■
M 28 ÷ ■ = 4
N 15 ÷ 5 = ■
O 16 ÷ ■ = 8

Test 3 1

A 5 × 3 = ■
B 28 ÷ 4 = ■
C 9 + ■ = 14
D 3 × 9 = ■
E 16 ÷ ■ = 2
F 14 − 8 = ■
G 6 + 9 = ■
H 12 + ■ = 3
I ■ + 6 = 11
J 17 − 8 = ■
K 9 + ■ = 16
L 14 ÷ 7 = ■
M ■ + 8 = 15
N 27 ÷ 9 = ■
O 8 × 4 = ■

Test 4 2

A 36 + 18 + 55 = ■
B 7 + 2 + 9 = ■
C 486 + 339 = ■
D 8 + 4 + 6 = ■
E 47 + 60 + 23 = ■
F 742 + 208 = ■
G 12 + 10 + 78 = ■
H 278 + 321 = ■
I 6 + 8 + 2 + 5 = ■
J 27 + 60 + 38 = ■
K 582 + 179 = ■
L 500 + 391 = ■
M 8 + 6 + 5 + 7 = ■
N 59 + 11 + 82 = ■
O 619 + 283 = ■

Test 5 2

A 580 − 177 = ■
B 214 − 114 = ■
C 823 − 299 = ■
D 620 − 581 = ■
E 900 − 726 = ■
F 41 − 17 = ■
G 725 − 418 = ■
H 306 − 258 = ■
I 52 − 35 = ■
J 635 − 489 = ■
K 27 − 9 = ■
L 872 − 325 = ■
M 91 − 74 = ■
N 904 − 632 = ■

Test 6 2

A $.76 + $.24 = ■
B $4.03 − $.95 = ■
C $1.82 − $.17 = ■
D $2.19 + $.83 = ■
E $5.96 + $1.74 = ■
F $1.15 − $.46 = ■
G $.77 + $.19 = ■
H $8.23 + $1.28 = ■
I $.28 − $.19 = ■
J $3.11 − $1.48 = ■
K $4.20 + $2.80 = ■
L $8.04 − $1.96 = ■
M $5.00 − $.62 = ■
N $.43 + $.57 = ■

Test 7 2

A ■ + 18 = 39
B 462 + 384 = ■
C 57 + 93 = ■
D 581 + ■ = 690
E ■ + 300 = 825
F 48 + 21 = ■
G 215 + ■ = 400
H 616 + 275 = ■
I ■ + 76 = 111
J 320 + ■ = 642
K 84 + 59 = ■
L ■ + 15 = 74
M 33 + 18 = ■
N 186 + ■ = 203

Achievement tests on computation 251

251

1 Tell the children to write each answer opposite its identifying letter.

2 The children should do the computation called for in each example and write the answer opposite the letter of the example.

Your notes

This section of the *Teaching Guide* contains detailed suggestions for teaching the lessons. The Expanded Notes are really enriched lesson plans that go beyond the minimal essentials described in the Lesson Briefs (pages 15-201). Before using these Expanded Notes, read the comments and examine the reproduced pages and keyed notes in the Lesson Briefs section. For your convenience, page references are made to the Lesson Briefs at the beginning of each set of notes in this section.

Expanded notes

The Expanded Notes for each lesson include:

Overview

A very brief survey of the lesson as it is developed from page to page in the pupil's book

Teaching the whole class

A plan of procedure to be used for the class as a whole before the children are separated into ability groups

Providing for the able pupil

Special suggestions for activities to extend the ideas of the lesson for abler students

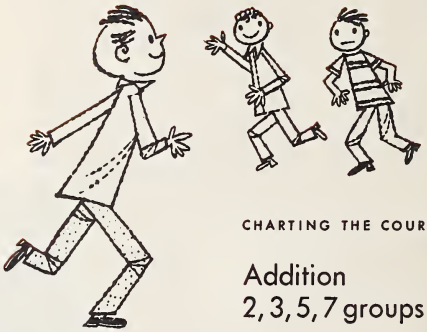
Helping the slow learner

Suggestions to use in making clear the ideas of the lesson and for motivating interest therein

A survey tour

of theory and method as applied to the arithmetic content of this course is provided in the Charting the Course sections included in the Expanded Notes.

Expanded notes



CHARTING THE COURSE

Addition
2, 3, 5, 7 groups

The arithmetic learned by children in the primary grades is a fundamental part of their education. It includes number concepts and skills needed daily by both children and adults as they meet quantitative situations in their activities. It is also the foundation for future learning of mathematics.

Because the fundamental concepts and skills of arithmetic are essential for effective living, children must be helped to learn them well. Moreover, successful learning leads to favorable attitudes toward arithmetic, and these attitudes in turn influence future learning. Most teachers are aware of this, and when starting the work of a new year in school, they help the children to reinforce the basic learning experiences of the preceding grades.

In a modern arithmetic program the pupil should learn the meaning and uses of addition at the same time that he learns the addition facts. The same is true of subtraction, multiplication, and division. Pages 3 to 36 of *Seeing Through Arithmetic 3* provide materials for teaching these meanings and uses and the basic facts for groups which number 10 or fewer. These facts are introduced by pictorial representations of four different types of situations—additive, subtractive, multiplicative, and

divisive. Pages 3 to 7 are devoted to the first of these types—additive situations.

Additive situations are those in which one group of objects is combined with another group. A situation in which one group is combined with another group can arise in several different ways. One group may be joined by another, as occurs when persons already at a table invite others to sit with them. In other situations, both groups may come together by joint action, as when two groups of friends at different houses agree by telephone to meet and walk toward each other along the same road. In still other cases, the groups may not be movable. For example, a farmer may wish to know the total number of fruit trees on his land. Although the trees in one orchard and those in another orchard form distinct groups physically, they would have to be considered a single group. In situations like this the groups are not put together in a physical sense, but are combined mentally, or by imagination. It will be convenient to describe all of these combining situations by saying "the action is *additive*." On pages 3 to 7 only the first type of additive situation is presented.

The number of objects in the two groups that are combining can be represented by number symbols. For example, the number of children in one group may be represented by the numeral 3. The number of children in another group may be represented by 4. The fact that the second group is joining the first may be expressed by the word *plus* and represented by the symbol $+$, which is read "plus." The word and the symbol are both general and conventional, and they include in their meaning a great variety of other ways of suggesting additive situations, such as *and, join, combined with,* etc. The situation described above is represented by $3+4$. The combined groups make a group of 7, and this is shown by writing $3+4=7$.

Addition is used in examples like that above when two numbers, each of which represents a group of known size, are to be replaced by one number that represents the sum—that is, the combined groups. These ideas may appear to be so obvious that there is no need to mention them here. Later, however, problem situations will arise in which a group of known size is being combined with another whose size is not known. These also are additive situations, but obviously are too complex for use in teaching the addition basic facts to children.

To describe both the situation and the process, the term *additive-addition* will be used. This term may be contrasted with *additive-subtraction*, which, as is explained in the section on Guiding Principles in the Introduction (see pages 6-7), describes a problem situation in which the action is additive, but in which the number symbols are subtracted.

As noted above, pages 3 to 7 in *Seeing Through Arithmetic 3* include pictorial representations of additive situations that are useful in reviewing the basic concept underlying addition. These pages present all of the facts for the groups 2, 3, 5, and 7, a set that includes 13 facts in all. None of the so-called "zero facts" is included at this point because the "zero facts" cannot be represented by concrete situations. The addition facts with sums of 4 and the facts with sums of 6 are not included at the outset because 4 and 6 are made up of two small groups (subgroups) that are equal. The recognition of equal subgroups (2, 2 or 3, 3) and the learning of multiplication facts are introduced later to avoid possible confusion in the child's mind as to the difference between addition and multiplication. The subgroups that are combined on pages 3 to 7 (for example, 2, 5 for 7) are small. The children should recognize the size of these subgroups by a quick look at the pictures. Some children who have not been taught to do this may have to count. They should be encouraged to learn to recognize the number without resorting to counting.

Pages 3 to 7 also provide materials for teaching those words of the basic arithmetic vocabulary used in talking about addition. Opportunities to respond to number situations expressed in those words (and signs) are included. Pupils who have used the primary materials of this arithmetic program* in the preceding grades will be familiar with the concepts and facts studied here. They will, however, enjoy demonstrating their knowledge and thereby strengthening it.

*Numbers We See by Mourice L. Hortung, Henry Van Engen, Anita Riess, and Catharine Mohoney. Scott, Foresmon and Company.

Numbers in Action by Maurice L. Hartung, Henry Van Engen, ond Catharine Mohoney. Scott, Foresmon and Company.

Our Number Workshop 1 and *Our Number Workshop 2* by Maurice L. Hortung, Henry Van Engen, and Cotharine Mohoney. Scott, Foresman ond Company.

Arithmetic Reodiness Cords, Set 1: Grouping and *Set 2: The Number System*, by Mourice L. Hortung, Henry Van Engen, ond Helen Polmer. Scott, Foresman and Company.

The Meoning of Plus ond Minus and *The Number System*, each eleven minutes in full color, available from Encyclopaedia Britonnico Films, Inc., Wilmette, Illinois, or from regional EBF libraries in New York, Dollos, Hollywood, Atlanto. These films were produced by Encyclopoedia Britannico Films, Inc. in colloboration with the authors of *Numbers in Action*.

3-6 Moving forward

Lesson Briefs for this lesson are on pages 16-19.

Overview

The work on these pages is designed to teach the child the addition basic facts for the 2, 3, 5, and 7 groups (those facts whose sum is 2, 3, 5, or 7). Page 3, which is entirely pictorial, develops the idea that addition means the combining of one group of objects with another group to form a larger group. Page 4 introduces the formal addition statement (5 boys plus 2 boys equal ▒ boys), the words *plus* and *equals*, the sign + and the sign =, and the equation (3+2 =▒). On page 5 the child meets the word *add* and learns what it means. The only thing on page 6 that may be new to some children is the computational form, in which the numbers are written vertically instead of horizontally.

No attempt will be made in these notes to set time limits for any lesson or lessons. However, do *not* attempt to do all the work on these pages in one lesson period. Use enough time, so that your pupils will feel comfortable and will have time to assimilate what they are learning before going on to something new. (See page 343 for a suggested time schedule.)

Present new words just as you do for a reading lesson. Vocabulary for these pages is listed on page 16 of the Lesson Briefs.

Note the statement beside the heading "Moving forward" on page 3. It has been included because the authors feel it is important for children to have some idea of what they are going to learn in a block of work. A similar statement is included for each succeeding block that introduces an idea. These statements should always be read and discussed in class before the new work is taken up.

The social theme for these pages is children's activities on their way to school and at recess. Let pupils discuss their own experiences and compare them with those shown in the pictures. Such discussion will stimulate interest.

Teaching the whole class

Page 3: Any classroom contains individuals who differ in ability and capacity for achievement. You will find that some pupils need many concrete experiences to master arithmetical ideas. Other pupils quickly tire of such activities. They need, instead, more challenging—usually more abstract—activities to keep them interested.

For those pupils with the most serious deficiencies in arithmetic, you may want to provide work at the second-grade level. *Numbers in Action** of this series will be very helpful. Activity suggestions for able and slow learners are made in separate sections at the end of these notes for pages 3 to 6.

One way to introduce the lesson is by asking the children what they saw on their way to school. After they have discussed their experiences, ask them to open their books to page 3. Give them time to look over the pictures and to comment on them.

Direct attention to the statement beside the heading "Moving forward." Tell the children that whenever they are going to learn something new they will find such a statement telling them what they are going to learn.

Now direct the children's attention to the first row of pictures. Make comments and ask questions such as:

Let's think of these pictures as a movie. There are three scenes in this movie. In the first scene [point to it], how many girls do you see? In the second scene, how many girls are coming to join the 3 girls? Now look at the last scene. What is happening in the last scene? How many girls are on their way to school? 3 girls and 4 girls are how many girls?

You may find it desirable to have the children use small objects (pencils, crayons, paper clips, etc.) on their desks to dramatize this joining action of the two groups. Or you may choose one pupil to demonstrate the action before the whole class. Adapt the following procedure as necessary. Say:

Let's pretend that these objects are girls. See if you can pick out 3 of them without counting. Put them down on your desks to represent the 3 girls on their way to school. Now off to the side put down 4 more objects for the 4 girls who are coming to join them.

Check to see that the children have put down a group of 3 objects and a group of 4 objects. Now say:

Move the 4 "girls" over to join the 3 "girls." [Show the children how, if necessary.] Now how many "girls" do you have altogether?

Quickly check the children's work to see that they have done it properly. Then let a pupil volunteer to tell the story of the girls on their way to school in his own words. It will probably be something like this: "3 girls are on their way to school. 4 girls are meeting them. Then there are 7 girls going to school."

Tell your pupils that there is a shorter way of telling this story. Explain that we can use the word *plus* when one group joins or is put with another group to make a larger group. Then go on:

So we can say "3 girls plus 4 girls equal 7 girls."

**Numbers in Action* by Maurice L. Hartung, Henry Van Engen, and Catharine Mahoney. Second-grade book in The Basic Mathematics Program. Scott, Foresman and Company.*

Ask a child to tell the story over again and say it in this way.

Movie B may be treated in the same way.

Picture C illustrates several additive situations in which one group of objects is combining with another to make a larger group. In these situations the combining action is going on between the two groups, but has not been completed. The children must imagine the resulting larger group.

Have them look over the picture as a whole first and find the groups of objects that belong together. To help them, you might ask questions such as these:

Put your finger on the boy with the wagon. Whom is he running to join? Now, who can show me some of the other groups in which animals are coming together?

Next ask the pupils to imagine that two groups of similar animals have joined. Get them to discover how many there will be in all. You might say:

Look at the two groups of birds near the fence. How many birds are sitting on the fence? How many birds are flying toward them? Imagine that the 3 birds that are flying have joined the birds sitting on the fence. Who will tell us the story about what is happening and the result when the two groups of birds have joined?

If necessary, have a pupil use objects to demonstrate the joining action for the class. Another possibility is to select two groups of children and let them pretend that they are the two groups of birds. Such activities will be especially helpful for the slower pupils.

Ask a pupil to tell the story in his own words, but guide him toward ending the story with the statement "4 birds plus 3 birds equal 7 birds."

Next call on other pupils and let each one select groups of animals he wants to tell stories about. Work for use of the words *plus* and *equal*. Note that the addition basic facts pictured are as follows: $4+3=7$ (birds on fence); $4+1=5$ (rabbits); $2+1=3$ (children); $1+1=2$ (dogs); $1+2=3$ (squirrels); $2+3=5$ (birds in tree).

To make certain everyone understands all the addition basic facts illustrated in Picture C, you may wish to ask the pupils to duplicate each pictured situation with objects on their desks, showing the two groups involved, the action, and the result.

On this page, and on succeeding pages as well, do not hesitate to let abler pupils help the slower ones. Be judicious, too, when asking for responses, and let the abler pupils respond in the more difficult situations. However, all pupils should participate in the various activities to the best of their ability.

Page 4: Before the children open their books to page 4, let them talk briefly about games they like to play at recess.

Let the children look over the page as a whole first. Then direct their attention to Picture D and ask questions like these:

What game are the boys playing? How many boys are playing marbles? How many boys are running to join them? Then how many boys will there be playing marbles?

If some children need more experience, let them use objects to show how many boys will be playing. Then call on a pupil to tell the story. Guide him toward using the words *plus* and *equal* in his story.

Next present the words *plus* and *equal* and any other new words just as you would in a reading class. Write "5 boys plus 2 boys equal 7 boys" on the board and ask someone to read this statement aloud. To introduce the idea of expressing this statement as a basic fact without reference to specific objects, ask:

How could I write this without using the word boys?

Write the response "5 plus 2 equals 7" directly under the statement "5 boys plus 2 boys equal 7 boys."*

Then ask your pupils to look at the story next to Picture D. Tell them to look at the third line, where they will see a screen (▒) covering the number that should be there. Say:

Whenever you read silently and come to a screen representing a number, stop and think *what the number would be and then go on reading. If you are reading aloud,* say *the number and go on reading.*

Tell the children to read the story to themselves. If they need help, tell them to look at the picture and imagine the two groups joined.

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1 Each form below follows good English usage:
(a) 1 duck plus 4 ducks is (equals) 5 ducks.
(b) 4 ducks plus 1 duck are (equal) 5 ducks.
(c) 1 duck and 4 ducks are (equal) 5 ducks.
(d) 4 ducks and 1 duck are (equal) 5 ducks.
(e) 1 plus 4 is (equals) 5.
(f) 4 plus 1 is (equals) 5.
(g) 1 and 4 are (equal) 5.
(h) 4 and 1 are (equal) 5.

In (a), (b), (e), and (f) the word *plus* is a preposition. In (c), (d), (g), and (h) the word *and* is a conjunction. Consequently, in (a) the singular subject *duck* requires the singular verb *is*. In (b) the plural subject *ducks* requires the plural verb *are*. In (e) and (f) the subject is an abstract number (1, 4). Abstract numbers are singular and take a singular verb. In (g) and (h) the subjects are compound and require a plural verb. The correct form will be used in this book, but children should not be required to observe the distinction between the situations that control the number of the verb. In subtraction the word *minus* is also a preposition.

Proceed in the same way with Pictures E and F. Before having the children read the story accompanying Picture F, however, it will be necessary to introduce the plus sign and the equals sign.

Write on the board the statement "3 girls plus 2 girls equal 5 girls." Ask the pupils how you should write this without using the word *girls*. The response should be "3 plus 2 equals 5." Write this on the board. Then tell the pupils that there are signs [write + and = off to the side] that are used in arithmetic for *plus* and *equals*. Write these words above the signs. Ask for a volunteer to come to the board and point out in your statement where these signs should be placed. If he points correctly, tell him to erase the words *plus* and *equals* and put the signs in their proper places. The statement should now be "3+2=5."

Now have the children take turns reading each line of the story for Picture F. They should supply the necessary numbers as they read.

Picture G and its story can be taught in the same way.

Next ask the children to look back at the story for Picture D. Write the last statement from it on the board. Ask someone to come up and erase the words *plus* and *equals* and put in the proper signs. Use this same activity for the story with Picture E.

To help the children recognize that forms such as 2+5=7 state generalized basic facts that cover all similar additive situations, try the following activity. Ask the children to make up stories about objects in the room that tell about a group of 5 joining a group of 2. On the board write one of their stories ("2 pencils plus 5 pencils equal 7 pencils," for example). Ask the class how they would write this without using the word *pencils*, but with the signs for *plus* and *equal*. Rewrite the story underneath. Now ask for another story. This time it might be "2 books plus 5 books equal 7 books," which you will write beside the first story. Ask the children for help in rewriting the statement in the form 2+5=7. Write at least two more stories on the board beside these and get the help of the class in changing them to the abstract form. Point out that the statement 2+5=7 stands for all of the different objects that could be arranged in groups of 2 and 5 and the group of 5 joined to the group of 2 to make a group of 7.

Use this same activity with all of the basic facts presented on this page. No work should be done with page 5 until all of the children understand that each of these addition basic facts can apply to many situations. You may wish to begin to use the word *add* when talking to the children, but do not at this time attempt to define it.

Page 5: This page illustrates more activities of girls and boys at play. Direct the children to open their books to the page. Introduce the work by asking questions about Picture H similar to those you asked about the pictures on page 4. Be sure to get the children to state the story of Picture H without using the word *boys*.

To introduce the word *add*, you may wish to use an activity similar to the following. Say:

Make a group of 4 objects [*pencils, crayons, etc.*]. *Off to the side make a group of 3. Now add the group of 3 to the group of 4. The word* add *means* to join *or* put with. *It is a word that tells us to do something, just as the word* run *does when you say, "Run to the corner." To show that you know what the word* add *means, move your group of 3 over to join the group of 4. Now that you have added the group of 3 to the group of 4, how many do you have altogether? "Add 3 to 4" means the same as "4 plus 3 equals how many?" When you read a sentence like "Add 3 to 4," you should think "4 plus 3 equals how many?" and say the answer.*

Next write on the board the sentence, "Add 3 to 4." Point out the word *add* and pronounce it. Also ask someone to come to the board and write the signs for *plus* and *equals*.

Ask your pupils to look at the story beside Picture H in their books. Tell them they will see the word *add* here and see the plus and equals signs used. Ask them to read the story over to themselves. Then call on a pupil to read the story and supply the answers. If he stops to supply the answer after reading "Add 3 to 4," that is all right, but is not necessary because the purpose of the sentence is merely to introduce the word *add* in a reading situation. The equation that shows what he would have to think to answer correctly is given on the same line.

The remaining pictures and stories on page 5 may be treated in the same way.

When you have finished the work on the page, use procedures similar to those outlined for page 4 to develop the understanding that each of the basic facts presented here stands for many stories about two groups of objects.

Page 6: Tell the children that on this page they will review some things they have learned about the 2, 3, 5, and 7 groups, and that they will also learn another way to write the numbers when they add.

Direct them to open their books to page 6 and to look at Picture A. Ask questions similar to these:

How many golf balls are in the larger group? How many are being put with them? Then how many golf balls will there be altogether? How would you

tell what is happening in Picture A, using the words plus *and* equal?

The response should be "4 balls plus 1 ball equal 5 balls." Tell the children to find this story in the first block of exercises (A to F). (Point to this block of work.) When they have found it, ask one child how the story is labeled [A]. Then ask him to read the story aloud, saying the missing number. Then say:

If there were apples in Picture A instead of balls, could we say "4 apples plus 1 apple equal 5 apples"? What could we say if there were dolls in the picture? What would we say so that it would mean four of anything plus one of the same thing?

The response to this last question should be "4+1=5." Tell your pupils to look at Picture A again to find this statement, or equation. Ask someone to point to it and read it aloud. Ask:

What does the 4 stand for? What does the 1 stand for? What does the plus sign show? What does the 5 stand for? In this picture, what does the 4 stand for? The 1? The 5?

Then tell your pupils that in Picture A they can find another way to write 4+1=5. Explain that we call it the *computational form.* Ask:

What does the 4 stand for? The 1? The 5? In this picture, what does the 4 stand for? The 1? The 5?

Tell your class that to read this they should start at the top and say, "4 plus 1 equals 5." If they are told to write "4 plus 1 equals 5" in computational form, they are to start at the top and write the 4, then the 1 below it, draw a line, and write the answer, 5. It is not correct or wise to tell them that the line is another way of writing "equals."

Use the same procedures with Pictures B to F. Notice that pupils will have to look for the exercises that match these pictures (Exercise D matches Picture B, etc.).

You may use the second block of exercises (A to N) in several ways. The children may take turns reading each statement of a basic fact aloud and supplying the answer. Then they may be told to write the letters A to N in a column on their papers and to write each equation with its answer, or only the answer, beside the appropriate letter.

The same kind of activities may be carried on with the exercises in the third block of work (A to R).

The abler students may be directed to convert each example in the second block of work (A to N) to the computational form, supplying answers. They may also be told to change the exercises in the third block (A to R) into the equation form, supplying answers. Do not require these activities unless the children can accomplish the work without too much difficulty.

Activity 1, described on page 312, will not only present practice work on the basic facts in an appealing way, but will also provide opportunities for independent work. Restrict the activity to the 2, 3, 5, and 7 groups. You will need cards showing 2, 3, 5, and 7 for box labels and two sets of cards showing the numbers 1 to 6. If you use objects, you will need a total of 7.

To conclude the work with this lesson, ask the children to read the statement at the top of page 3. Then direct their attention to the statement with the flag before it at the bottom of page 6. Tell them to read it silently. Then call on someone to read it aloud. Ask for volunteers to tell about the numbers they have learned to add to make 2, 3, 5, and 7. You might suggest to the class that if any of them do not feel sure they have learned to add the numbers that make 2, 3, 5, and 7, they should tell you, and you will be glad to help them.

Providing for the able pupil

Toward the end of the block of work let the abler pupils use Activity 2, page 313, confining it to the thirteen addition basic facts that have been studied.

Helping the slow learner

An understanding of number groups and of ways of regrouping them forms the basis for much of the work in this book. It is assumed that children understand that each number name and symbol through 10 corresponds to a specific quantity, collection, or group of objects. Children need to have a kind of mental picture, gained through many concrete experiences, of the size of each number group through 10. They need to be able to recognize, without counting, groups of 2, 3, and 4 objects, and to see larger quantities or groups as made up of two or more of these smaller groups. They should have many experiences in seeing groups of objects arranged into two smaller groups. For example, they should have a mental picture of a group of 5 as composed of groups of 2 and 3 and of 4 and 1. Such experiences are the foundation for the study of the basic facts. Children who have used *Numbers We See* and *Numbers in Action* will be familiar with principles of grouping. For those children who need to become better acquainted with these principles, and who are being slowed up by counting activities, it is suggested that concentrated help be given. The pictures of groups found in the *Arithmetic Readiness Cards, Set 1: Grouping** and the activities suggested for use with these cards, should be helpful here.

**Arithmetic Readiness Cards, Set 1: Grouping,* by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

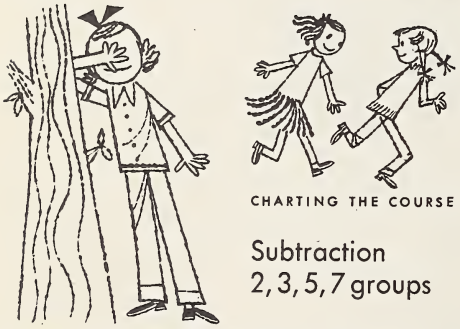
Children who need more concrete experiences with the basic facts taught in this lesson may try the following activity as soon as a few of the addition basic facts have been met in story form.

From a stack of cards on which are printed stories similar to "1 doll plus 4 dolls equals 5 dolls," let a child choose one story and clip it in the space provided on a card-holder chart. From a set of blank cards, each one representing one of the objects in the story, let another child choose the correct number of cards to illustrate the story. As the group, or a third child, reads the story, let the second child clip the cards that illustrate the groups and action involved onto the card-holder in space provided below the story. For complete details, see Activity 3, pages 313-314.

7 Keeping skillful

Lesson Briefs for this lesson are on page 20.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Subtraction
2, 3, 5, 7 groups

When a part of a group of objects is separated from the whole group, the situation is called *subtractive*. For example, a group of 7 children are playing. If 4 of this group leave, the situation is subtractive. It can be represented by the symbols $7-4$. Since 3 children remain, the symbols $7-4=3$ represent not only the initial situation and the action, but also the result. The process through which the symbols $7-4$ are replaced by the symbol 3 is called *subtraction*.

Subtractive situations can arise in a variety of ways. In the example above, there was originally a group of known size (7). Then a subgroup, also of known size (4), was taken from it. Now consider another somewhat similar situation. Suppose it is known that originally a group of children were playing, but it is not known how many there were. Next, suppose someone says that 4 of the children have gone and only 3 remain. This also is a subtractive situation. It can be symbolized in various ways: for example, $\square-4=3$, or $\_\_-4=3$, or $?-4=3$. In this situation a group of known size either was taken away from, or went away from, a group of unknown size. Although situations like this may occur in practical problems, obviously they are not suitable for introducing children to the process of subtraction and the basic facts. Children should come to see subtraction as the process through which two number symbols, representing two groups of known size, are replaced by one number symbol which represents the situation after a subtractive action has occurred, as in $7-4=3$.

The reason for dwelling on these seemingly obvious ideas may now be made clearer. First, in the arithmetic program of which *Seeing Through Arithmetic 3* is a part, subtraction is given meaning in terms of *subtractive actions* only. The question "What number, plus 3, gives 7?" may be symbolized as $?+3=7$, or $\square+3=7$. The answer may be found by subtraction ($7-3=4$), but the situation is additive, and not suitable for a meaningful approach to subtraction. Eventually, children should learn that although the meaning of subtraction comes from subtractive situations, the process is used in other situations in which there is no subtractive action. Later, examples of such situations will be given and explained. For the present, it may be noted that the term *subtractive-subtraction* describes both the type of situation used to introduce the idea and the process used with symbols. However, this term is *not to be taught to the children.*

In *Seeing Through Arithmetic 3*, pages 8 to 12 contain pictorial representations of subtractive situations that are useful in teaching the basic concept underlying subtraction. All the facts for the 2, 3, 5, and 7 groups are presented, but none of the zero facts is taught at this time. There are, in all, 13 facts in this set. The subtraction facts for the 4 group and the 6 group are not included because both 4 and 6 have equal subgroups, and it is desirable at this stage to defer the divisive concepts. These pages also provide materials for teaching the related words of the basic arithmetic vocabulary and for practice using only the symbols. Page 13 is a practice page including all of the addition and subtraction facts taught up to this point. Pupils who in the preceding grades have used other materials of this arithmetic program will be familiar with these concepts and facts. They will, however, enjoy demonstrating what they know and thus reinforce their previous learning. Those

not familiar with preceding materials may gain new insight into meaning.

8-12 Moving forward

Lesson Briefs for this lesson are on pages 21-24.

Overview

The general purpose of pages 8 to 12 is to develop the subtraction basic facts for the groups 2, 3, 5, and 7 while teaching pupils to recognize subtractive situations. The method of presentation is similar to that used in presenting the addition basic facts for the same groups on pages 3 to 6. Page 8, which is entirely pictorial, develops the idea that removing a subgroup from a group is a subtractive situation. On page 9 the meaning of the word *minus* and of the minus sign is made clear. Page 10 introduces the word *subtract*. The computational form on page 11, in which the numbers are written vertically instead of horizontally, may be new to some pupils. Page 12 provides practice material in both equation and computational form for the basic facts introduced in this lesson.

Do not attempt to complete the work on these pages in one lesson. Give your pupils ample time to assimilate what they are learning.

Remember that the opening and closing statements of the lesson are placed there for the children's benefit and should be read and discussed in class.

The general social theme of these pages is activities in connection with a day at school. Children should associate the pictures with their own activities in the classroom.

Teaching the whole class

Page 8: Start the new block of work by asking your pupils to turn to page 8, where they will see pictures of boys and girls at school. As the children look over the page, allow them to make comments about it.

Then direct their attention to the statement beside the "Moving forward" heading at the top of the page. Ask:

Do you remember what this part of the page is supposed to tell you when you see the words "Moving forward"? John, read it aloud to us.

Tell your class that they are going to learn something new about the groups 2, 3, 5, and 7.

Ask them to look at Movie A. Explain that the boys and girls are playing a game. Let the children look over the three scenes and describe what is going on. Then, to focus their attention on the subtractive actions, ask questions somewhat like these:

In the first scene, how many children are sitting on chairs? How many children are leaving in the second scene? In the last scene, how many boys and girls are left sitting on the chairs?

Explain that just as the word *plus* is used to talk about one group joining another group, so there is a word to show that a group is leaving or being taken away from a larger group. Tell them that the word is *minus*. Have them tell the story of what is happening in Movie A by saying, "5 children minus 2 children equal 3 children."

This statement may have more meaning if some of the children are given an opportunity to dramatize it. Call on volunteers to act out Movie A. Then ask one of the group to tell the story, using the words *minus* and *equal*.

Next tell the children to put about 10 objects (crayons, pencils, etc.) on their desks. Ask them to pretend that the objects are the children in Movie A. Say:

Put down 5 objects for the 5 children sitting on the chairs. Now separate 2 objects from the group for the 2 children going away. Use the side of your hand to move them away. Now pick up the 2 objects. How many children do you have left? 5 children minus 2 children equal how many children?

You may use the same procedures in developing understanding of the fact shown in Movie B.

In Picture C several subtractive situations are illustrated. In each case the action of separating one group from a larger group is taking place but has not been completed. The children must imagine the action as completed and the group that will be left.

To get the children to think about the subtractive situations in the right way, you might direct them to look at the girl at the board. Ask:

How many cars were drawn on the board? How many cars is the girl erasing? How many cars will be left when she finishes erasing? You can also use objects to find out. Put on your desks 7 objects for all the cars that were drawn on the board. Now take away enough objects to show the cars that are being erased. How many are left? 7 cars minus 4 cars equal how many cars?

Call on different pupils to find in the picture a story they wish to tell about. The stories should be somewhat like this one: "There were 3 pictures on the bulletin board. 1 picture fell down. Then there were 2 pictures. 3 pictures minus 1 picture equal 2 pictures."

To make sure that all the children understand all the basic facts shown in Picture C, you may ask them to illustrate each subtractive situation with objects and find out how many are left. Check to see that the children are using the right number of objects for

the total group in each case and that they are removing the correct subgroup. The subtraction basic facts illustrated in Picture C are: $7-4=3$ (cars on the blackboard); $3-2=1$ (plants); $7-2=5$ (boxes of crayons); $5-4=1$ (jars on the table); $5-3=2$ (books in the bookcase); $3-1=2$ (pictures on the bulletin board).

To provide additional practice, you can state the subtraction basic facts presented so far and ask children to point out the picture or movie that illustrates each. If the picture does not show how many are left, the children must imagine the action as completed and the group that is left. For example, if you said, "5 books minus 3 books," the child should put his finger on the part of Picture C that shows this situation. If he is unable to imagine the action completed and the group that is left, you may tell him that he can pretend to remove the 3 books by covering them with his fingers. Then he can see how many are left.

Page 9: Ask your pupils to turn to page 9 and look at the pictures. Ask them to decide whether the groups on this page are being combined or separated. Then tell the children that there are stories to read about each picture, but that you would like to hear their stories first. Have them look at Picture D. Ask:

How many pictures were on the table to begin with? How many is the girl taking away? Then how many will be left? 7 pictures minus 3 pictures equal how many pictures? Who will tell us the story of Picture D? Be sure to use the words minus *and* equal.

To help the children move toward more abstract ideas of subtraction, you might ask them to think of a way to say "7 pictures minus 3 pictures equal 4 pictures" so that the 7 could refer to *any group* of 7 objects from which 3 are being taken away. The response "7 minus 3 equals 4" should be written on the board.*

Next ask pupils to read the story at the right of Picture D silently and think of the numbers hidden by the screens. Then call on a pupil to read the whole story and give the answers.

Picture E and its story may be treated in the same way. This would be a good time to introduce the word *subtract* to the children. (This word appears in the reading material on page 10, but it may be used orally here.) A good time to do this is when directing them to duplicate the situation in Picture E with objects. You might say:

Put down a group of 7 objects. Now you are going to subtract 5. Subtract *is a word that means* to take away *and is a word that tells you to do something. What is another word that tells you to do something?* [Add] *Show me that you know what the word* subtract *means by taking away a group of 5.*

Check the children's work to see that they remove 5 objects. Then ask how many are left.

Before the children read the story for Picture F, write the expression "7 minus 6 equals 1" on the board. Tell the children that just as there is a sign for the word *plus* (write + on the board), so there is a sign for the word *minus*. Off to the side write the minus sign (−). Then ask a pupil to come up and put this sign and also the sign for *equals* in the right places. The result should be $7-6=1$. Finally have the children read the story for Picture F, supplying the missing numbers.

Deal with Picture G and its story in a similar way. Then go back to Pictures D and E and ask two pupils to go to the board and rewrite the last sentence in each story, changing the words *minus* and *equals* to the appropriate signs and supplying answers.

You will probably want to spend some additional time developing the idea that expressions like $7-6=1$ and $7-1=6$ state generalized basic facts that apply to all similar subtractive situations. Ask the children to think of different objects that might be placed in a group of 7 and from which a group of 6, for example, might be taken. Ask them to tell stories about this situation, using the words *minus* and *equal.* As with the similar exercise on helping them move toward the abstract addition facts explained in the preceding lesson, write these stories on the board. Get the children to remove the noun that makes the story specific, and help them see that in each case a form like $7-1=6$ covers all similar situations. Be sure to have the children tell stories that cover all the subtraction basic facts presented on this page. Throughout the work on this page, continue to use the word *subtract* in questions and discussion.

Page 10: The activities pictured on page 10 should give the children much to talk about as they recall similar experiences of their own. You might focus attention on Picture H by asking questions like these:

How many girls do you see in Picture H? What have they been doing? How many are leaving? Then how many will be left? How would you say

*The statements that were made when discussing the number of the verb to be used with *and* and *plus* apply, to a lesser degree, to the word *minus*. There is never any question about the number of the verb when *minus* is used in concrete statements (5 ducks minus 1 duck are 4 ducks), because the subject is always plural. However, when the abstract form is used (5 minus 1 is 4), the verb is always singular. This distinction will be maintained throughout this book, but the children should not be required to observe it.

this, using the words minus *and* equal *as you did for the stories on page 9?*

To review the word *subtract,* say:

Put objects on your desks for as many girls as there are in Picture H. [*Check quickly.*] *Now take away one girl from the two girls.* [*Check to see that the children remove one object from the group of two.*] *How many do you have left when you subtract 1 from 2?*

Write the phrase "Subtract 1 from 2" on the board and tell your pupils that they will find this expression in the story at the right of Picture H. Have them read the story silently, saying the answers. Then call on children to take turns reading each line aloud. If the pupil who reads the last line stops to give the answer, that is all right, but it is not necessary, since the purpose in this case is merely to introduce the word *subtract* in a reading situation. The equation that shows what he must think to get the answer is on the same line.

Next have the children tell what is happening in Pictures I, J, and K and the results, using the words *minus* and *equal.* Then call on pupils to read the accompanying stories, giving answers where necessary.

To check on the children's understanding of the abstract basic facts, like $7-4=3$, ask various children to explain what each of the numerals and signs means. By this time they should be able to say that an expression like $7-4=3$ stands for any story that could be told about a group of 7 objects from which a group of 4 is being taken. If some of the children have difficulty in understanding this, have them make up stories using the basic facts they have been studying and building them around objects in the classroom. Then help them to generalize.

Since all the subtraction basic facts for the 2, 3, 5, and 7 groups have now been presented, you might like to help the children gather together their knowledge of the subtraction basic facts for each of these groups.

To do this, you can make use of a flannel board and have children demonstrate on it all the subtraction basic facts they have learned about each number group. See Activity 4, page 314, for complete details.

Instead of participating in this activity, the abler children might like to write the subtraction basic facts for each group on a chart similar to the one suggested for basic facts in addition. See Activity 2, page 313. Do not ask the children to write these facts in computational form, since this form is not introduced until page 11.

Page 11: Tell the children that they will review some things they have already learned and that they will also learn another way to write numbers when they subtract.

Ask the pupils to look at Picture A and see if they can imagine that what is happening is completed and what the result will be. Call on a pupil to tell this story, using the words *minus* and *equal.* He should end his story by saying, "7 dogs minus 4 dogs equal 3 dogs."

Ask your class to look at the sentences at the top of the page (A to F) and find the one that tells about Picture A. Call on someone to read it aloud. Then ask the pupils to find in Picture A the equation form of this sentence that covers all situations in which 4 objects are taken from 7 objects. Ask them to put their fingers on it as one pupil reads. Then ask the pupils to point out the other way to write this fact. They should point out the vertical, or computational, form. Ask:

In the picture what does the 7 stand for? What does the 4 stand for? What does the 3 mean? How should you read the numbers?

If your pupils do not know how to make the statement, tell them how: "7 minus 4 equals 3."

It is not correct or wise to tell the pupils that the line underneath the two figures is another way of writing "equals." Moreover, it is best not to have them write the minus sign beside the computational form. The computational form is only a convenient arrangement for processing numbers, and numbers are never written in this form until after the operation to be done is decided upon. Thus, the use of the minus sign in the computational form as a means of telling what is to be done is a purely artificial device. Mathematics teachers object to this use of the plus and minus signs because it causes confusion when positive and negative numbers are taught.

You may proceed in the same way with Pictures B to F. Note that for each picture the children will have to look for the matching exercise (Exercise B matches Picture C, etc.).

Before doing the other exercises on this page, the children might like to try the following activity, which provides practice in writing subtraction basic facts in the equation form.

Let each child think of a story based on one of the subtraction basic facts he has learned. He can ask another pupil to show with objects the groups involved, the separating action, and the result. Then he should ask this second pupil to go to the board and write in the equation form the fact that covers all similar stories. For example, the first pupil might say, "I had 5 pencils, and I gave 2 pencils to John. How many pencils did I have left?" The child selected would put down 5 objects, move 2 away, and show 3

left. Then he would go to the board and write $5-2=3$. It would be his turn to tell a story next.

After you have started this activity, let the children carry it on independently. Be sure to have the children work with their objects where all can see—preferably at a table or desk in front of the group.

The exercises in block 2 (A to T) may be used in various ways. The children may take turns reading them orally and giving the answers. They may also write the letters A to T in a column on their papers and write each example with its answer, or they may write only the answer beside the corresponding letter. The abler children may also be directed to change these exercises to the computational form.

The third block of exercises (A to R) provides the children with practice on the subtraction basic facts in computational form. Direct the children to copy the letters and the exercises and write the answers.

Page 12: Tell your pupils that they are going to find out how much they know about the subtraction basic facts for groups of 2, 3, 5, and 7.

Ask them to look at Pictures A, B, and C and decide what is happening in each picture. Ask them to be ready to tell a story about each picture, using the words *minus* and *equal.* When they have done this, ask them to change each statement into the form that covers all such situations involving the same groups.

Next give each pupil a chance to read aloud and supply the answer for at least one of the exercises in the first block (A to S). Then direct the class to write the answers for these exercises. They may write the letters A to S on their papers and write the answer after each. If any of the children need objects to find answers, they should be allowed to use them.

The exercises in block 2 (A to X) and those in block 3 (A to N) may be handled in the same way. Go through the exercises orally first; then use them as written work.

Finally, call the children's attention to the printed statement at the bottom of the page. Have someone read the statement aloud. Then call on various class members to give you examples of subtracting from the numbers 2, 3, 5, and 7 to prove that they have learned how to subtract. Encourage any of the pupils who feel they have not yet learned to subtract to come to you for more help. Early diagnosis of difficulties and special help at this time for those who need it will pay dividends to both pupils and teacher.

Providing for the able pupil

Some of the children may enjoy making a booklet illustrating the addition and subtraction basic facts. This activity will take several weeks to complete, but the final result will be a booklet showing all the basic facts through the 10 group, arranged according to groups. For complete details, see Activity 5, page 315. Note that at this stage the child can be expected to illustrate *only* the addition and subtraction basic facts for the 2, 3, 5, and 7 groups.

For another activity, addition and subtraction basic facts (without answers) may be arranged in rows on cards in such a way that in each row one answer does not fit into a relationship shared by the others. This activity will test both the child's knowledge of the basic facts and his ability to perceive a pattern of relationships among answers. See Activity 6, page 316, for details in making up the cards and for instructions to give to the children in using them.

Number stories that have blanks to fill and which require a knowledge of the basic facts can make an interesting independent activity for children. The stories should be typed on cards for selection and use by the children in their spare time. See Activity 7, page 316, for details.

Helping the slow learner

Activity 7 suggested above may be adapted for the slower learners. Stories for them should consist of two or three sentences with a blank or screen in the last sentence only. The abler children might be encouraged to make up these shorter stories and write them on cards.

Activity 3, with the card-holder chart (see page 313), may be adapted for use with subtraction basic facts. For this activity prepare in advance story cards on which subtraction basic facts (5 dolls minus 1 doll equal 4 dolls) are written. The blank cards used for the addition activity may be used for the subtraction activity also. Cards with the subtraction basic facts in equation form ($5-1=4$) may be prepared to carry this activity along another step; or they may be prepared in the form $5-1=\square$, so that the children may perform the activity and supply the answer. Each child should select a story card, read it aloud, and insert it in the upper portion of the card-holder chart. He should then select the proper number of blank cards to illustrate the story. For the story above about the dolls, for example, he should select 5 cards and insert them under the clips in the lower section of the chart. As he does this, he should say "5 dolls." Then as he removes a card, he should say "minus 1 doll," and point to the 4 cards left as he says "equal 4 dolls."

If some children have difficulty remembering certain basic facts, suggest that they make practice cards with these basic facts (without the answers) on them in equation form. They can use these cards for practice, either with a partner or alone. For further details about making the cards, see Activity 8, page 317.

13 Keeping skillful

Lesson Briefs for this lesson ore on pages 24-25.

Expanded Notes are not considered necessary for this lesson.

CHARTING THE COURSE

All processes
4, 6, 8, 9, 10 groups

The methods of teaching the addition and subtraction basic facts for the remaining groups through 10 are similar to those used for the 2, 3, 5, and 7 groups. Each of these remaining groups (4, 6, 8, 9, 10) also involves some multiplication and division facts.

If several groups of equal size are combined, the situation may be called *multiplicative*. For example, suppose there are 9 cars in a parade and 4 people are in each car. The question is how many people there are in all. The situation may be shown in symbols by writing 9×4, and the process in which 9×4 is replaced by 36 is called *multiplication*. In multiplicative situations, attention is focused upon a set of equal groups that are combined. The number of objects in each of these equal groups must be noted and also the number of equal groups. When both these numbers are known and are used to find the number in the combined group, the process is called *multiplication*.

On the other hand, suppose a group is to be separated into equal subgroups. This situation is called *divisive*. In one kind of divisive situation, the size of the subgroup is known, and the number of such groups that can be formed is to be found. This type of action is called the *quotitive* (or "measurement") type. This is the type of situation by which the division basic facts are taught. For example, 12 crayons are to be separated into subgroups of 4 each. How many such groups will there be? The situation is commonly shown in symbols by writing $12 \div 4$, and the process in which $12 \div 4$ is replaced by 3 is called *division*.

In another type of divisive action, the number of subgroups to be formed is known, and the size of each subgroup is to be found. This type of action is called *partitive*. For example, 12 crayons are to be separated into 3 equal subgroups. How many will there be in each subgroup? This type will be discussed in more detail later. Only quotitive (or "measurement") situations are used in this book to teach the division facts.

Some vocabulary difficulties arise in connection with multiplication and division. Children should learn the meaning from actual manipulation of objects and from study of pictures of objects so arranged that equal subgroups can be recognized. If children acquire meanings in this way, the question as to whether one should say "2 threes are 6" or "2 times 3 is 6" is unimportant. One of these verbal expressions is no more "meaningful" than the other. Both are merely ways of stating a situation, and it is the situation that is, or is not, meaningful. Both statements are in common use, and both should be taught.

In the situation described by "2 threes," it is conventional, at the present time in this country, to write the numeral representing the number of equal groups at the left and to call it the *multiplier*. Thus, in 2×3 the symbol $\times$ (read *times*) indicates multiplication, and the whole expression represents 3 multiplied by 2.

In the case of division, $12 \div 4$, for example, is read "12 divided by 4," and there is no single word or name for the symbol ($\div$). In this expression $12 \div 4$, the *divisor* is at the right. If 2×3 were to be read "2 multiplied by 3," and 3 regarded as the multiplier, a strict parallelism would exist between the verbal expressions for multiplication and division. The modern tendency to use expressions like "2 threes" and "2 times 3" has broken down this parallelism and created a situation that sometimes leads to difficulty when the basic concepts are not made clear by using objects and pictures. It is hardly possible to overemphasize that verbal distinctions are of little or no help to the pupil and can safely be ignored if the underlying multiplicative and divisive *situations* are adequately taught. Instead of emphasizing a particular way of stating a multiplicative situation, all of the ways in common use should be taught.

On pages 14-20 additive, subtractive, multiplicative, and quotitive divisive situations (of the type in which the number of equal groups is to be found) are pre-

sented in that order for the 4 and 6 groups. The same sequence is then followed for the 8, 9, and 10 groups on pages 21 to 36. At this stage no attention is given to the fact that subtraction is the "opposite" of addition, or vice versa. The individuality of each of these types of situations (additive, subtractive, multiplicative, and divisive) is preserved, and no explicit attention is given to relations between them. This completes the presentation of all the basic facts for groups of 10 or fewer.

14-16 Moving forward

Lesson Briefs for this lesson are on pages 25-27.

Overview

These three pages develop the addition and subtraction basic facts for the 4 and 6 groups (those facts in which 4 and 6 are sums and minuends). There are eight addition and eight subtraction basic facts for these two groups. Symbols and terminology used in previous work with the 2, 3, 5, and 7 groups are used again in this lesson. The computational form for both addition and subtraction is used again on page 16.

Be sure that the children read and discuss the opening and closing statements for this lesson. It is important that they have an idea of the objective of the lesson, and also that they understand what learning should have been achieved when the lesson has been completed.

Make use of objects and dramatizations whenever it seems necessary to reinforce the ideas in the book. Since the social theme of this lesson is a children's party, relate class activities to this theme whenever possible.

Teaching the whole class

Page 14: Before having the children turn to page 14, allow them to talk about parties for a few minutes. Try to center the discussion on table decorations and favors, as such articles are shown on pages 14-16.

Next ask the children to look at the pictures on page 14. Let them discuss the pictures before you turn their attention to the sentences beside the heading "Moving forward." Ask a pupil to read these sentences aloud.

Now the children are ready to start the lesson. Ask them to look at the three scenes in Movie A. Ask:

Are the groups of children joining or separating? Is this a story about adding or subtracting?

Ask the children to look quickly at the other pictures on the page to see what is happening and then to tell whether this page is concerned with adding, subtracting, or both. Let them tell how they know.

After the class has determined that this page is concerned with adding, tell them to look at Movie A again. Ask:

How many girls are seated at the party table? How many girls are joining them? In the last scene, how many girls are seated at the table? Who will tell us this story, using the words plus *and* equal?

Call on six children to dramatize the action in Movie A. Have one child tell the story as the six children act it out. Then ask another pupil to tell the story, leaving out the word *girls*. The response should be "4 plus 2 equals 6."

Next direct the children to look at Picture B. Ask them to imagine that 1 hat has been joined by 3 hats. Let one of the pupils tell the complete story, using the words *plus* and *equals*. Then ask the children to look at the story at the right of Picture B. Introduce any new reading words. Ask someone to read the first three sentences, saying the missing number.

Call on a pupil to read the next sentence: "Add 3 to 1." Ask another pupil to show what this means. He should demonstrate in front of the class the action of putting 3 objects with 1 object, using any convenient objects.

Get someone to restate "Add 3 to 1" as "1 plus 3 equals how many?" Then ask someone to find this statement in the story. He should point to the next statement, $1+3=\square$. Ask him to read this, saying the missing number for the screen.

Pictures C and D and their stories may be handled in the same way.

Page 15: The pattern of pictures and stories on this page is the same as on the preceding page except that subtraction is illustrated. Therefore, adapt the procedures outlined for page 14 to the work on page 15.

Have the children observe that the work on page 15 is also about the party. Have them note first the subtractive action in all the pictures. Then ask them to tell stories about these pictures in their own words and to read the accompanying stories, answering all questions and supplying all missing numbers.

Page 16: Before the work on this page is started, tell the children that on this page they will see some of the things used at the party. Then have them look at Picture A. Ask questions somewhat like these:

How many place mats are in the larger group? How many are being put with the group of 3? Then how many will there be? Find a story that fits this picture in the statements labeled A to F at the right. Read it silently and think *the missing number. Now, who will read it aloud?*

Use the same procedure for Pictures B to F. Since the statements A to F refer to abstract facts, some of

the children may have a little difficulty in making the transition from the concrete pictures to the accompanying abstract statement. You may have to go through a few more steps with them for each picture. For example, you may write on the board the statement "3 mats plus 1 mat equal ▤ mats." Then by erasing the nouns, change the statement to "3 plus 1 equals ▤." Explain that this statement, when the answer is put in, is true for all situations in which 1 object is put with 3 objects.

The slow learner will benefit from using objects to show each pictured situation and the result of the action.

For the exercises in block 2 (A to R), have the children take turns reading each one aloud and saying the answer. Then they may place the letters A to R in a column on their paper and write each answer opposite its identifying letter.

Have children copy the exercises in block 3 (A to L) in computational form and write the answers. Draw attention to the fact that in some of these exercises they are to add, while in others they are to subtract.

When these exercises have been finished, call on a pupil to read aloud the statement at the bottom of the page. Tell the pupils that if some of them feel they do not know how to add the numbers that make 4 and 6 or how to subtract from the numbers 4 and 6, they may come to you for more help.

For a concluding activity, the children might like to work in small groups and dramatize stories that they make up, illustrating in turn all the basic facts studied so far. In this way they can review the facts for the 2, 3, 5, and 7 groups, too. While one group of children dramatizes its story (4+2=6, for example), the rest of the children should write the basic fact on paper. To organize this work, direct the children to write across their papers the headings, "2 group," "3 group," "4 group," etc. (up to and including the "7 group"). Then, as a basic fact is dramatized, they should write it under the proper heading.

Providing for the able pupil

Continue with any of the following activities already started by now, including the addition and subtraction basic facts for the 4 and 6 groups:

A. Booklet illustrating basic facts (see Activity 5, pages 315-316)
B. The cards with basic facts arranged in five rows of five facts each in such a way that all but one of the answers in each row will be in a definite order (see Activity 6, page 316)
C. Story cards with blanks (see Activity 7, pages 316-317)

Helping the slow learner

Continue with these activities, already started, by including now the basic facts for the 4 and 6 groups:

A. Card-holder chart (see Activity 3, page 313)
B. Story cards with one blank (see Activity 7, pages 316-317)

17-18 Moving forward

Lesson Briefs for this lesson are on pages 27-28.

Overview

The work on pages 17 and 18 focuses on teaching the multiplicative idea (the combining of equal groups to make one larger group). The three multiplication basic facts for the 4 and 6 groups are taught, and the terminology of multiplication is introduced.

Page 17 is entirely pictorial. By two-scene movies the action of simultaneously combining equal groups to form one larger group is shown taking place and completed. This page should be thoroughly discussed in class. It gives the opportunity for oral use of such terms as "multiply," "multiplied by," etc.

The pictures on page 18 show multiplicative action taking place. The resulting larger group has to be imagined.

The social theme for these pages is a puppet show. If string puppets are available, it may be wise to demonstrate to the class how they work.

Teaching the whole class

Page 17: Ask the pupils if any of them have seen a puppet show. If some of them have, let them describe a puppet show. Be sure to bring out that puppets are attached to strings that are used to make them move.

Then ask the pupils to turn to page 17, where they will see pictures of puppets. Let them look at the pictures and talk about them.

Next present any new words and call on a pupil to read the statement beside the "Moving forward" heading to find out what new things the class is going to study. Be sure everyone understands what "equal groups" are. If any of the pupils seem uncertain, draw on the board six small squares arranged as 5 and 1. Nearby draw six small dots arranged in two groups of three each. Ask the children to look at the two groups of squares. (Point to them.) Ask:

Do these two groups have the same number of squares in each? How many do you see in each group? How many are there altogether? Now look at the dots [point to them]. Do these two groups have the same number of dots in each? How many are in each group? How many do you see altogether?

Explain that when there are the same number of objects in two or more groups, we say the groups are equal. Then ask your class to look again at page 17. Call on pupils to point out pictures that show equal groups. Then say:

Look at what is happening in Movie A. How many puppets are there in each group in the first scene? Are the groups equal? How many groups of puppets are there? Are all of the groups of puppets going toward the same place, or away from the same place? How many puppets do you see in the second scene, where the puppets have come together? We can tell this whole story in this way: "3 groups of 2 puppets equal 6 puppets." If we don't want to use the word puppets, *we can say "3 groups of two equal 6." A shorter way of saying "3 groups of two" is to say "3 twos." Then 3 twos equal how many?*

Next tell the children that you want them to use objects to show that 3 twos equal 6. First ask them to put on their desks 3 groups of 2 objects each, as in Picture A. (Check to see that they do this correctly.) Then tell them to move the 3 groups of objects together all at the same time. Tell the children they may use both hands to do so. Check to see that they have six objects together. Call on someone to tell the story.

You will want to introduce next the expression "multiplied by." One way to do this is to say:

There is another way we can talk about putting groups of equal size together. Instead of saying "3 twos," we can say "2 multiplied by 3." [*Write this on the board.*] *So if 3 twos equal 6, then 2 multiplied by 3 equals how many?*

You can use the same procedures with Movies B and C.

To reinforce the learning of the multiplication basic facts introduced on this page and the concept of multiplication, give the children many opportunities to act out simple multiplication stories, using books, chairs, and other objects around the room. You might say:

Jim and Mary, will each of you bring 3 books and put them down on the table at the same time? How many books are there altogether on the table? Mary, tell us this multiplication story, using the word books.

The response can be "2 groups of 3 books equal 6 books" or "3 books multiplied by 2 equal 6 books." Then ask one of the abler students:

Jim, can you tell this story without using the word books? *In what other ways can you tell this story?*

The responses can be "2 groups of 3 equal 6," "2 threes equal 6," or "3 multiplied by 2 equals 6."

Page 18: Let the children look at these pictures of puppets and make comments about them. Tell them that on this page they will continue to learn about the equal groups that make 4 and the equal groups that make 6.

Now direct the children's attention to Picture D. Ask questions such as these:

How many frogs are in each group here? How many equal groups of frogs are there? Put objects on your desks arranged as the frogs are. Now move one group of your objects with one hand and at the same time move the other group with the other hand so that these two equal groups come together. How many frogs do you have altogether?

Before asking the children to look at the story at the right of Picture D, introduce any new words by writing them on the board. Tell the children to read the story and be ready to give the answers. Then ask questions and guide the reading somewhat as follows:

Peggy is going to read the first three lines aloud for us. As she finishes reading each line, let's all look at the picture to see if the story is right. When Peggy comes to the last line with the screen covering the number, imagine that the 2 groups of 3 frogs have jumped into the pond. How many frogs will there be in the pond? Then, Peggy, say the missing number as you finish reading the line.

Let pupils take turns reading the remaining lines, saying the missing numbers. Explain that "2 threes" is another way of saying "2 groups of 3" and that "3 multiplied by 2" is equivalent in meaning to "2 threes."

Pictures E and F and their stories may be treated in the same way.

Dramatizations or activities with objects may be necessary to clinch understanding of what multiplication is and of the basic facts presented.

To conclude the page, have the children read the statement at the bottom. Ask them to tell what equal groups they have learned to put together in this lesson. You may write the basic facts on the chalkboard as they are given.

At this time children should be able to describe in their own words what happens as another child (or the teacher) puts equal groups of objects on the table and moves them together. Encourage the children to use the words "multiplied by." This activity may also be used with the teacher stating the situation and the children illustrating the action.

Providing for the able pupil

Since only three multiplication basic facts have been presented in this section, no special activities will be necessary at this time.

Helping the slow learner

For those who need more practice, the card-holder chart (Activity 3, page 313) may be used to illustrate

multiplication stories. For this activity, story cards with the three multiplication facts in both concrete and abstract form should be prepared in advance.

19-20 Moving forward

Lesson Briefs for this lesson are on pages 29-30.

Overview

In the work on these two pages, the child is introduced to the divisive situation (the separating of a group into smaller equal groups), and he learns the three division basic facts for groups of 4 and 6. Two-scene movies on page 19 illustrate these three division basic facts (Movie A shows $6 \div 2$; Movie B, $4 \div 2$; and Movie C, $6 \div 3$). The first scene in each movie shows the original group, while the second scene shows this group as composed of smaller equal subgroups.

Page 20 introduces the terminology of division. The pictures on this page show only the equal subgroups for groups of 4 and 6. The children must imagine the original total group from which these subgroups were formed.

Since this is the children's first planned encounter with division, reinforce the work on these pages by letting them use a variety of objects. Let them separate 4 or 6 of these objects into their equal subgroups. Such concrete experiences are especially helpful to the slower pupils.

The puppet show is continued as the social theme of this lesson.

Teaching the whole class

Page 19: To introduce this new work, have the children turn to page 19 and read silently the statement beside "Moving forward." After one child has read it aloud, encourage discussion as to what the statement means. Stimulate the children's thinking by such questions as:

What does the word separate *mean? What are* equal groups?

Tell the children that you are going to let them discover into how many equal groups 6 objects can be separated. Tell them to put 6 objects on their desks and move them about until they find that they have separated the 6 objects into groups having the same number in each group.

Check the children's work. Ask a child who has separated his objects into two groups of 3 to make two drawings on the board, using X's. One drawing should show six X's together; the other should show the equal groups he discovered he could separate 6 into.

Then ask a child who has separated his 6 objects nto three groups of 2 to draw his arrangement of three groups of 2 on the board. Tell all the children to put their 6 objects together again and to separate them in the two ways that have just been demonstrated.

You might ask also if they can discover any other ways to separate 6 objects so that there are equal groups. (If a child should separate his 6 objects into ones, tell him that he is correct and that he will learn more about this later on.) Summarize their work by saying:

Six objects can be separated into how many groups of 3? Six objects can be separated into how many groups of 2?

Then tell the children to take 4 of the objects and to find all the ways in which these 4 objects can be separated into equal groups. Have a child draw his arrangement of two groups of 2 on the board.

Now ask the children to turn again to their books and to look at Movie A on page 19. Let them discuss the animal puppets shown. Then go on:

How many zebras are there in the first scene? In the second scene, are the zebras separating, or are they going together into one group? How many are in each group? How many groups are there? The 6 zebras are separating into how many groups of 2 zebras?

Tell the children next that the word *dividing* can be used in place of the word *separating* into equal groups. Explain that another way to say what is happening in the second scene of Movie A is to say that the 6 zebras are dividing into three groups of 2 zebras.

Use the same procedures for Movies B and C. Ask questions that get the children to use the correct statements in telling the stories. Gradually guide the children into changing the stories into an expression such as this: "4 divided by 2 equals 2."

The children might like to dramatize situations that involve these three division basic facts. For example, ask 4 children to stand in a group and by twos walk a few steps apart to show that 4 divided into twos equals 2.

Page 20: Tell the pupils that on page 20 they will find some stories about dividing, and that a picture will help them answer the questions or find the missing numbers in each story. Introduce any new words. Then tell the children to read the story (four sentences) at the right of Picture D silently. Tell them to put 6 objects on their desks to represent the group of lambs and to show the separating action with their objects.

After the story has been read, say something like this:

Remember that 6 divided by 3 is just another way of saying "6 divided into threes." What does "6 di-

vided by 3=2" stand for in Picture D? Look around the room and name some other objects that the 6 in "6 divided by 3=2" could stand for.

You may use the same procedures in working with Pictures E and F.

Conclude the lesson on this page by having the pupils read the statement at the bottom of the page. Ask them to tell into what equal groups 4 and 6 can be divided. Write the basic facts on the board as the children state them.

Providing for the able pupil

Since only three division basic facts have been presented in this lesson, no special activities should be needed.

Helping the slow learner

Adapt the card-holder chart (Activity 3, page 313) for use with division basic facts. Prepare in advance cards with the three division facts in both concrete and abstract form.

21-25 Moving forward

Lesson briefs for this lesson are on pages 31-33.

Overview

For the first time in this book, addition, subtraction, multiplication, and division basic facts are presented in one block of work. Only the basic facts for the 8 group are taught in this lesson (there are seven each for addition and subtraction, two each for multiplication and division). Be sure that the children have ample time in which to do this work.

Page 21 illustrates six of the seven addition basic facts for the 8 group (7+1 is pictured on page 25). Methods similar to those used in previous treatments of addition may be used to teach page 21. The component groups are shown, and the child has to imagine them as put together. Some children will need to use objects and dramatizations to "see" the total group.

The pictures on page 22 employ previously used procedures to teach six of the seven subtraction basic facts (8−2 is pictured on page 25). Again, the action has been initiated but is not completed, and the child must imagine what the remaining group will be.

The two multiplication basic facts for the 8 group are illustrated by two-scene movies on page 23. The learning of multiplication is also extended to the introduction of the words *multiply* and *times*. (*Multiplied by* is introduced on pages 17-18.)

On page 24 the two division basic facts are pictured, and the word *divide* is introduced. (*Divided by* is introduced on pages 19-20.)

The arrangement of pictures and materials for practice on page 25 makes it necessary for the child to discriminate among the four processes, thus providing a check on his understanding of the work taught in this treatment.

The general social theme for the block of work on pages 21 to 25 is "Making toys," and the pictures show tools and supplies that might be used, as well as some completed toys.

Teaching the whole class

Page 21: Before the children turn to page 21, let them discuss toys that they could make at home or at school. Suggest doll beds made out of cigar boxes and tops made out of spools, and then ask the children to describe any toys they have made. Ask also about the tools needed to make the toys (nails, hammers, saws, etc.).

Tell the children that on the next five pages of their arithmetic book they are going to see pictures of tools used in making toys and also some toys made by other children.

Have the children turn to page 21 and ask them to read the "Moving forward" statement. When they have finished reading it silently, ask them to tell what number they are going to learn about. Ask the class to look at all the pictures on the page. Let them try to discover what they are going to learn about the number 8 on this page. Get them to identify the objects pictured.

Then turn the pupils' attention to Picture A. Ask questions like the following:

How many saws are in the smaller group? How many are in the larger group? What is the hand doing with the group of 3?

Next tell the pupils to put on their desks two groups of objects arranged in the same way as the saws in the picture. Tell them to try to do this without counting the objects. Then ask them to move the group of 3 objects over to the group of 5. Ask them how many they have altogether in one group. Finish with the question "5 saws plus 3 saws equal how many saws?" Next direct their attention to Story A. Introduce any new words, and have the children read the story silently. Then call on pupils to take turns reading each line aloud, saying the missing numbers or adding when they are directed to do so.

Proceed with the remaining pictures and stories in the same way. With Picture C, however, make sure that the children recognize the action as additive and not multiplicative. Your questions and comments should make it clear that one group is being joined to the other group. The action is *not* that of the simultaneous joining of equal groups.

If some of the children need more practice with the addition basic facts for the 8 group, extend the

activity introduced for the 2, 3, 5, and 7 groups to the 8 group. For this prepare cards with the new addition basic facts on them. (See Activity 1, page 312, for directions for carrying on this activity.)

Page 22: The procedures suggested for page 21 may be adapted to the pictures and stories on page 22. Have the children look over the pictures as a whole first and discover that on this page they are learning how to subtract from 8.

It is unlikely that the children will mistake the subtractive action in Picture D for divisive action. However, in discussing this picture keep attention centered on the removal of one group and the size of the group that is left. Do not comment on the equality of the groups.

Page 23: To begin work with this page, have the children identify the objects in Movie A. Direct them to read silently the first four lines at the right and use the picture to get the answers. Ask one child to read the lines orally and tell the answers.

Then tell the children that as they read the next six lines, they will meet two new words. Write the word *multiply* on the board and tell them it is used when equal groups are combined. Tell them that *multiplied* is another form of the word. Then say that there is another new word that they can use when multiplying. Write the word *times* on the board. Explain that instead of saying "2 threes equal 6," they can say "2 times 3 equals 6."

Next have the children look at these remaining six lines for Movie A. Explain to them that these are different ways of telling what the two scenes in the movie show. Call on a pupil to read aloud the first line, "4 groups of 2=▒," saying the missing number. Ask him what the 4 and the 2 stand for in the picture. Ask another pupil to read the next sentence, "4 twos =▒," saying the missing number. Have him explain what "4 twos" stands for. Be sure the child knows that he is talking about four groups with two objects *in each group*.

Ask another pupil to read the third exercise and show with objects what 2 multiplied by 4 equals. Tell him he may call on someone to help him move his objects into one group in a new location.

Explain that the next sentence, "Multiply 2 by 4," is a direction to multiply, just as "Add 2 to 4" or "Subtract 2 from 4" are directions. Ask the pupil who reads his sentence to give the answer.

When Line 5 has been read, ask the pupils if they understand that "4 times 2" is just another way of saying "2 multiplied by 4." Call on one of the children to read the last line, saying the answer. Ask him to show with objects what 4 times 2 equals, using the picture if necessary. Tell him he may have help from a classmate in moving his objects together into one group. Point out also that in the expression "4 times 2" the numeral at the left of the word *times* shows the number of the groups, and the numeral at the right, the size of the equal groups.

Picture B and the reading material at its right may be handled in the same way.

Exercises A, B, and C at the bottom of the page give opportunity to practice using the new words *times* and *multiply*. Call on one pupil to read and to answer each part of Exercise A. Call on two other pupils to answer Exercises B and C. To conclude this work, get the pupils to state the multiplication facts for the 6 group in these two different ways.

Page 24: Procedures used with page 23 may be adapted to this page. Have the children first look at the pictures and decide that they show dividing. Call on pupils to tell how they know.

Then direct their attention to Movie A and the story at the right. Have them use the pictures to answer or verify the first three lines. Explain that the next three lines are different ways of telling the story of Movie A, and that the sentence in the last line, "Divide 8 by 4," is a direction to do something, just as "Add 2 to 4" is. Use the same procedures with Movie B, being sure to introduce any new words before they are met in the reading material.

Have children take turns answering Exercises A to E orally. They may use objects to find the answers if they need to do so.

Page 25: Have the children look at Story A. Call on one pupil to read the first line aloud. Say:

Find the picture above that shows 8 spools in a box. What letter is beside the box? [*E*]

Call on another pupil to read the second line. Ask: *What picture shows Don giving Billy 2 spools? What letter is beside this box?* [*B*]

Ask another pupil to read the third line. Tell him to use Picture B to find the number that belongs where the screen is. Have someone read the whole story, saying the missing number. Then ask someone to state the equation that the story and the two pictures show ($8-2=6$). Write it on the board.

Proceed in the same way for each of the remaining stories. Tell the children that for each story they will have to find two pictures. One will be the center picture, E, which will show either the group they start with in the story or the group they must end with. The other will be one of the pictures A to D.

When the children have formulated the equation for Story B, write the equation, using the words *divided by*. Ask:

8 divided into twos equals how many? Divide 8 by 2.

For Story C, write the equation, using the word *times.* Ask:

4 multiplied by 2 equals how many? 2 fours equal how many?

In Exercises A to P pupils practice various ways of stating the basic facts. Handle these exercises orally at first, calling on pupils to give the answers. If some of them do not as yet "know" the answers, help them with their thinking. For example, with Exercise A, "Multiply 4 by 2," ask:

How many groups of 4 are there? 2 fours equal how many? 2 times 4 equals how many? What is the answer to "Multiply 4 by 2"?

For Exercise C, ask:

How many objects are there altogether? How many will be in each group? 6 divided into twos equals how many groups? 6 divided by 2 equals how many?

The children may also work out the answers with objects if they feel that this will help them.

After these exercises have been done orally, direct the children to write the letters A to P and after each letter to write the answer for that exercise. Tell them that they may use objects if they wish. Give the children plenty of time to do this exercise.

To conclude the work, have the class read the statement at the bottom of the page. Call on various pupils to demonstrate that they have learned to add, multiply, subtract, and divide with the 8 group. Let them use objects to show the action involved and the result. Then have them tell in their own words what happened.

Providing for the able pupil

After the addition and subtraction facts for the 8 group have been studied, the abler children may continue making the two charts, one for the addition basic facts, the other for the subtraction basic facts. These charts will eventually show all the addition and subtraction facts through the 18 group, arranged by number groups. From such charts the children will be able to make several generalizations. They will see how many addition and subtraction basic facts there are for each group and generalize that there is one more fact for each group than there is for the previous group, up to and including the 10 group, after which the number of facts for each group decreases by one. See Activity 2, page 313, for a more complete description and drawings of the two charts.

Helping the slow learner

The card-holder activity previously suggested (see Activity 3, page 313) may be used to help the slow learners become better acquainted with the multiplication basic facts. For this activity prepare cards with the facts in his form: 2 times 3=6.

As another activity, let children put into a box or take out of it groups of objects to illustrate the multiplication or division basic facts you state. For example, if you asked one of them to show what 4 times 2 is, he should assemble from a collection of objects 4 groups of 2 and put them into the box to show that they equal 8.

26-29 Moving forward

Lesson Briefs for this lesson are on pages 34-36.

Overview

Six of the eight addition basic facts for the 9 group are introduced and pictorialized on page 26. The two remaining facts (1+8 and 7+2) are shown on page 29.

Page 27 introduces six of the eight subtraction facts, and the two remaining facts (9−3 and 9−1) are presented on page 29.

Since for the 9 group there is only one multiplication fact ($3\times3=9$) and one division basic fact ($9\div3=3$), both are introduced on page 28. This page also presents the multiplication sign ($\times$) and division sign ($\div$), thus rounding out the pupils' knowledge of the symbolism used for these two processes.

Give the children time to discuss the social theme of the pictures—"A trip to the toy store." Whenever it seems necessary, use objects and dramatizations to develop the basic facts taught on these pages.

Teaching the whole class

Page 26: The procedures suggested for page 21 may be adapted for the pictures and stories on page 26. Since the action indicated in the pictures on page 26 is incomplete, allow the children to use objects to determine the size of the total group when necessary.

Page 27: You may adapt the procedures suggested for page 22 to this page. Allow the children to use objects, if they need to, to find the size of the remaining group.

Page 28: To begin work with this page, have the children look at Movie A to see if they can tell what has happened. Then have them read the first four lines of text silently, using the two scenes of Movie A to get answers or to verify facts. Then call on pupils to take turns reading the lines aloud, supplying answers.

Before going any further, you will want to introduce the sign for multiplication. To do this, you may write on the board the sentence "2 times 3=6." Tell

your pupils that there is a special sign for multiplication just as there is for addition and subtraction. Write the times sign ($\times$) off to one side. Then call on a pupil to come to the board. Direct him to erase the word *times* and put this sign in the sentence where it belongs. Be sure the children see the difference between the plus sign and the times sign.

Now call on pupils to read the next three lines. Point out that in the first and third lines there are two expressions. Explain that in each case the two expressions mean the same thing.

Next have the children look at Exercises A to F. Ask one child to read Exercise A orally and to give the answer to each equation. Explain that both equations in Exercise A, when read aloud, sound the same, but that the times sign is usually used when writing arithmetic. Ask all the children to write the letters A to F in one column on paper and to write these equations once, using the times sign and supplying the answers.

The movie, text, and exercises on division may be handled in the same way. Throughout the work on multiplication and division, emphasize the equality of the groups.

Page 29: Ask the children to look at Picture A. Ask questions similar to these:

How many bells are in the smaller group? How many bells is Betty moving toward it? 1 bell plus 8 bells is how many? 1 plus 8 is how many?

Then have the children read Problem A silently. Call on a pupil to read it aloud, saying the missing number. Use the same procedure with the remaining pictures and problems.

Handle Exercises A to R orally first. Let the children use objects, if necessary, to find the answers. Help them to form equations for such exercises as "Subtract 1 from 9." Then tell the children to write the letters A to R in a column on their papers and write the equation for each exercise, giving the answer. Remind them to use the signs they have learned when they write the equations.

Providing for the able pupil

If Activity 2 is being used, direct these pupils to include the basic facts for the 9 group on their charts.

Helping the slow learner

As soon as the times sign has been introduced, the cards (see Activity 1, page 312) may be prepared for the multiplication basic facts studied so far. The child should select the card bearing the fact equal to the answer you have clipped to the box and say the complete fact as he drops the card in the box.

As further help for the 9 group in subtraction, give each child nine objects and help him to show all the subtraction facts for this group by repeatedly separating the nine objects into two groups and removing one group.

To get this activity started, tell the children to put the nine objects on their desks and write on a piece of paper the numeral 9 that stands for the nine objects. Next tell them to push away any number of objects they want to, so that there are two groups. They are to note the number of objects in the group they have pushed away. Then direct them to pick up these objects. On their paper after the numeral 9 they are to write the minus sign and the number of objects they have picked up. Ask them to look at the group remaining on their desks and write the equals sign and this number after the first part of their equation on the paper. Then tell them to begin again with 9 objects and to repeat the whole procedure, this time removing a different sized group of objects. They are to write the new equation directly under the first one on their papers.

Have the children repeat this procedure until they think they have shown all the subtraction basic facts for the 9 group. Then have them look in their books for each of the facts they have discovered. As they find a picture and story in their book that match one of the facts they have shown, they should put a mark (C, check mark, etc.) on their papers after that fact. (Remember that the facts $9-3=6$ and $9-1=8$ are not presented until page 29.)

30-34 Moving forward

Lesson Briefs for this lesson are on pages 36-39.

Overview

The work on these five pages develops the addition, subtraction, multiplication, and division basic facts for the 10 group (those facts whose sums, minuends, products, and dividends are 10).

The pictures on page 30, illustrating six of the addition basic facts, show one group combining with another group. The resulting larger group must be imagined. Accompanying text material uses the symbols and terminology of addition.

Page 31 introduces six of the subtraction basic facts for the 10 group. These are taught by means of pictures and accompanying symbolization in a manner similar to that used for the addition facts.

The two multiplication basic facts for the 10 group are introduced pictorially in two-scene movies on page 32. Multiplication terminology and symbols that the children have already met are used here again. The computational (or vertical) form of multiplication is introduced.

Page 33 presents the two division basic facts in a manner similar to that used for the multiplication facts. The computational form of division is also introduced.

The addition and subtraction basic facts not introduced on pages 30 and 31 ($9+1=10$, $3+7=10$, $8+2=10$, $10-8=2$, $10-4=6$, $10-1=9$) are presented on page 34 through pictures and text. This page also includes a brief review of the basic facts taught thus far in all four processes.

The social theme of this lesson is "Things children might eat or use at picnics."

Teaching the whole class

Page 30: Procedures suggested for teaching the addition basic facts for the 8 group (Expanded Notes for page 21, appearing on page 221) may be adapted for this lesson.

Before starting this lesson, let the children talk about picnics they have attended. Explain that the pictures and stories on the next five pages are about things they might eat or use at picnics.

Page 31: Six of the nine subtraction basic facts for the 10 group are presented on this page. Procedures for teaching these facts may be adapted from those for the Expanded Notes for page 22 (appearing on page 221).

Page 32: Have the children use Movie A to answer the questions or verify facts given in the first four lines of the text. The movie also will help the children supply the missing numbers in the exercises below the questions.

After one child has read aloud the equation $5\times2=$▒, ask him to find this same equation written in Movie A. Direct the children to find the example labeled "Multiply." Explain that this is another way to write "Multiply 2 by 5." Show pupils how to read it from the top down, "Multiply 2 by 5." Ask the pupils to find this new way of writing multiplication in Movie A. Call on someone to point it out. Direct attention to the answer. It should also be written on the board. Write the word "Multiply" and have a child write the new form of the basic fact underneath.

The work on the other multiplication basic fact for the 10 group ($2\times5=10$) may be handled in the same way.

Exercises A to G at the bottom of the page provide practice, in computational form, on the multiplication basic facts learned so far. Let the class take turns reading these and giving the answers orally. Have the children rewrite these exercises in equation form, supplying the answers.

Page 33: Suggestions in the Expanded Notes for page 24 (see page 221) may be adapted for this page.

Since the computational form of division is new to the children, explain this form and have them find the examples shown in Movies C and D.

The two blocks of exercises at the bottom of the page may be handled both orally and as a written assignment. See suggestions in the Expanded Notes for page 32.

Page 34: Have the children look at Pictures A to F and decide which show adding and which show subtracting. Then call on different members of the class to tell the story of each picture. As each child finishes his story by making an equation that fits all similar situations, ask him to find the matching equation in Exercises A to F at the top right. He is to say the letter of the equation that matches the story in the picture and then read the equation, giving the answer.

For Exercises A to J, let children take turns giving the answers orally. If those called upon cannot give immediate answers to Exercises A, E, I, and J, help them to arrive at the necessary equations. Some of the children may need to use objects. Next have all the children write the equations and answers for Exercises A to J.

The abler children may like to change each of these equations into computational form and write answers. Be sure that they label each example.

Have the children copy Exercises A to H and write the answers in place of the screens. The abler children may like to change each of these exercises to equation form, including the answers.

To conclude the lesson, ask the children to read silently the statement beside the flag at the bottom of the page. Ask one pupil to read it aloud.

Providing for the able pupil

To provide practice on the addition basic facts after the 10 group has been studied, the game described in Activity 9 may be introduced. See page 317 for instructions on making the cards and for details on playing the game.

Number Top is a game that may be used by two, three, or four children to practice the addition and subtraction basic facts through the 10 group. See Activity 10, page 318, for further instructions and illustrations of the board and spinner.

Activity 11 may be used with pages 32 and 33. See pages 318-319 for complete details.

Multiplication and division basic facts may now be included among the facts on the cards for Activity 6. Suggestions for rows of basic facts arranged so that one of the answers does not fit into a relationship shared by the others are shown on a card illustrated on page 316.

Those pupils who have been working on the booklet illustrating the addition and subtraction basic facts through the 10 group (see Activity 5, page 315) should now be able to finish their booklets.

Helping the slow learner

After children have learned the addition basic facts through the 10 group, the game of Add-Up may be introduced. This game involves competition between two players who strive to supply the greater number of answers to addition facts written on a specially prepared board. For directions for playing the game and instructions for making the board and markers, see Activity 12, page 319.

Number Bowling, a game involving ten clothespins, can provide slow learners with practice on the subtraction basic facts for the 10 group. See Activity 13, page 319.

35 Keeping skillful

Lesson Briefs for this lesson ore on pages 39-40.

Expanded Notes are not considered necessary for this lesson.

36 Checking up

Lesson Briefs for this lesson ore on poges 40-41.

Overview

In *Seeing Through Arithmetic 3* there are 55 tests which may be used to inventory what has been learned and to measure achievement. These tests are arranged in groups under the heading "Checking up." The first set is on page 36 of the child's book. Throughout the book many of these tests require only one operation (for example, addition). Usually the facts and abilities tested are those that have just been studied. This enables the children and the teacher to use the tests *diagnostically*. If a child cannot respond, or if he makes errors that are not just the occasional careless slips characteristic of childish behavior, he usually needs more learning experiences before going ahead with new work.

In preparing *Seeing Through Arithmetic 3*, much attention was given to making a book that children could read, study, and understand. The pictures closely relate the learning to concrete situations. The complete yet simple explanations are written in a carefully controlled vocabulary. In many cases, then, the best material for any needed reteaching is found in the pages where the explanation was originally given. It is true that children have difficulty in reading or studying typical arithmetic texts, with the result that both teacher and pupils come to regard the textbook chiefly as a source of practice exercises. Ideally, however, it should be a common experience for children to reëxamine materials they have studied earlier whenever the need arises. *Seeing Through Arithmetic 3* was designed with this possibility always in mind.

Some of the tests in "Checking up" sections include mixed types of exercises (see, for example, Tests 7 and 8 on page 36). These tests are more appropriate for securing achievement scores than for diagnosis. The other tests are primarily diagnostic.

The tests on page 36 require knowledge of basic facts only, and for such exercises answers are not included in this Teaching Guide. For other types of exercises that come later, the answers are given, and there are also references to pages in the children's book where exercises of that kind are first taught. When test results indicate that a child has forgotten something or needs additional learning experience, help him to find the appropriate pages in his book.

CHARTING THE COURSE

The equation in problem solving

Up to this point the children have been introduced to four types of problem situations (additive, subtractive, multiplicative, and quotitive division). For each type their attention has been focused on the action taking place, and they have been shown how the situation can be represented by symbols. Thus, if a group of 3 boys joins a group of 2 boys, the situation can be symbolized as $2+3=\square$ The children have not, as yet, been required to write an equation like this themselves.

If children are to become successful in problem solving—and this is one fundamental objective of arithmetic—they must learn to *describe the situation by writing the arithmetical symbolization for it.* Pages 37-41 provide a careful introduction to this important phase of problem solving. The children are shown step by step how to form the equation. They also are required to distin-

guish carefully between the equations that describe additive situations and those describing subtractive actions. Similarly, attention is directed to the difference between the equations for multiplicative and divisive situations.

It may be well to emphasize here that equations of these simple types have been used in teaching arithmetic at this grade level (or earlier) for years. It is common to find forms like $3+2=\_\_$, or $7-4=?$, or $7+?=9$, or $3\times5=?$, and still others, in arithmetic books and workbooks. This equation form is advantageous for describing the problem situation. Read in the normal fashion from left to right, it shows the thinking in the order in which it occurs. Moreover, it places the operational signs ($+$, $-$, $\times$, $\div$) between the numerals, and thus treats them as essential parts of the thinking.

The vertical form, on the other hand, is a computational device. In genuine problem solving, one never writes the numbers in vertical form until after he has decided what operation is to be performed. There is then no need to write the operational symbol with the vertical form. The custom of attaching operational symbols to the vertical form in practice materials was probably originated for the purpose of indicating the operation to be performed. This is of no help in genuine problem solving, and it is not needed if the equation form is used to show the essential thinking.

This distinction between the use of the equation form to show the *thinking* and the vertical form to help with the *computation* becomes much more striking as the problems become more difficult and the computation becomes more complex. It is well, however, to begin making the distinction before these complexities arise. Pages 37-41 of *Seeing Through Arithmetic 3* introduce the pupil to the way in which the horizontal form comes into being.

37-41 Exploring problems

Lesson Briefs for this lesson are on pages 41-44.

Overview

These five pages give children the basic techniques needed to solve problems. The objective of the work on these pages is to get children to recognize the problem situation—shown in pictures or described in words—and to use arithmetic signs and symbols to describe the problem situation.

Page 37 shows how to build an addition equation and a subtraction equation. Movie sequences show the groups involved, the action taking place, and the result. Step by step, along with the progress of these scenes, the proper symbolization is put down, with a screen (▤) used to represent the number that is missing in each case.

Page 38 provides practice in determining whether a problem situation is additive or subtractive. Pictures showing the groups involved and the action taking place help the children determine not only what numbers are involved, but also what signs should be used in the equations they build.

Page 39 shows how to build both multiplicative and divisive equations. Three-scene movies show the groups involved, the action taking place, and the result. Symbols and signs accompany the movies and record each of the steps in the problem situation, thus making an equation.

Page 40 provides practice in determining whether problems are multiplicative or divisive and in setting up the proper equation to describe each problem situation.

The last page of the lesson provides problems, without illustrations, for which equations are to be made and the answers found. Pupils should, if necessary, be allowed to use objects in solving these problems.

The social theme for this block of work is "Visiting in the country."

Teaching the whole class

Page 37: Before the children open their books to this page, ask them about the different animals they have seen in the country. Find out if any of them have ever had a ride on a pony. Write the words *ponies* and *barnyard* on the board if they are new to the children's vocabulary. Then tell them to look at page 37.

Tell the class to read the sentence opposite the first scene of Movie A. Call on someone to read it aloud. Then ask the class what they see under the sentence. Have them tell what the 4 stands for. Be sure the children understand that the arrow is pointing to the four ponies in the picture.

Direct the children to read the next sentence. Then call attention to the second scene of the movie. Continue somewhat as follows:

How many ponies are inside the barnyard? How many ponies are coming through the barnyard gate? Does the running of these ponies to join the others make you think of addition, subtraction, multiplication, or division? Why?

Direct attention next to the expression $4+2$ in large type. Say:

What has been put with the numeral 4? What does the 4 stand for? The plus sign? The 2? Do these numerals and the sign tell the story of the movie

so far? Do they tell all the story that you have read so far?

Ask the children to read the question that comes next and to look at the numerals and signs below it (4+2=▒). Ask what has been put with the 4, plus sign, and 2. Tell them that this whole statement is called an *equation*. Direct them to look at the third scene of the movie to see what number belongs in place of the screen. Call on a pupil to read the equation, saying the missing number.

You may continue in the same way for Movie B and its accompanying text. This time stress the subtractive action.

Page 38: Before work with this page is begun, ask the children to print a large plus sign on one side of a piece of paper and a large minus sign on the other side. Then tell them to lay the paper aside and to open their books to page 38. Explain that each picture on this page shows a different problem situation.

Call on a pupil to read the first sentence aloud. Ask the children to point to the three squirrels that are eating. Have a child read the next sentence aloud. Tell the class to point to the two squirrels that are running to eat. Ask them how many squirrels will be eating together. Have another child read the next sentence and supply the number that the screen is covering.

Next have the children look at the equation. Explain that the wavy line (⁓) means that a word or sign is missing and that the screen, as usual, is covering a numeral. Ask the class to hold up the paper so that you can see the sign that they think belongs in place of the wavy line. Be sure to note any of the children who are holding up the wrong sign, because they are the ones who will need the most help. Then call on one child who is holding up the right sign to tell the class which sign belongs in this equation and why. Have him read the equation, saying the numbers and *plus* for the missing sign.

With Picture D and its story, be sure to draw attention to the fact that only one number is given in the equation and that the children must supply the other number, the sign, and the answer. Have them look at the picture and read the accompanying text in the same way they did for Picture C. When they come to the equation, ask them to hold up the correct sign.

The remaining pictures and stories (E to H) may be handled in the same way. For each of these, the children must build the entire equation. When all the equations have been worked out orally, ask the children to write the equation for each picture and its story after the letters C to H.

Page 39: Procedures suggested for page 37 may be adapted for this page.

Page 40: Before beginning work with this page, have the children make a multiplication sign on one side of a piece of paper and a division sign on the other. Then adapt procedures from the Expanded Notes for page 38.

Page 41: Before having the children look at the individual problems, introduce any words new to their reading vocabulary. Then go over the first five problems with the class. Ask questions that help the children to determine the number of objects in the groups involved, the action that occurs, and from this action the type of problem situation each is.

Caution the class not to answer the problems immediately, even though they may know the answers. Tell them you want them to think of the equation first. Explain that later the problems will be harder and they will not know the answer immediately. Then it will help them to know how to write the equation. As each equation is completed, have a child write it on the board.

Problem F is the first problem for which no help is given in the book. Ask questions similar to these:

How many pictures did Betty paint? How many did she give to Mother? Is the action in this problem that of adding, subtracting, dividing, or multiplying? Why? What is the first number you should write in your equation? What sign should you write to show that the action is that of subtracting? How many pictures were in the group that Betty gave to Mother? Where should you put this number? What sign should you write next? Instead of giving the answer immediately, what can you draw to stand for the number you are to find?

When the equation has been set up with the screen (or with a square, □), rewrite it, and ask a pupil to tell the missing number. Some of the children may still need to use objects to help them.

Have the children solve each of the other problems by writing the equation twice—first with the screen in place of the answer, then with the missing number inserted. Instead of a screen, they may draw a square. Afterward, go over the problems orally and have the children mark their own papers.

Finish the lesson by having someone read aloud the statement at the bottom of the page.

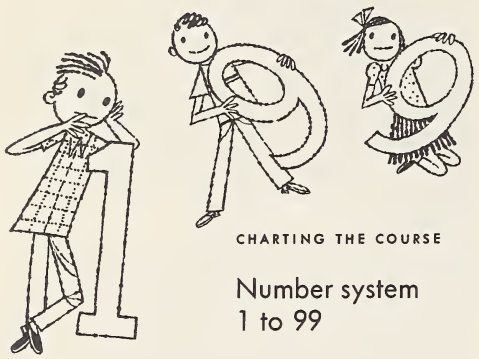
The written work for Problems F to M may indicate that some pupils did not understand very well how to make equations from problem descriptions. Perhaps these pupils might work individually, or in a small group, with a child who has demonstrated ability in handling this lesson. Discussion and work with objects should enable them to set up the correct equations.

Providing for the able pupil

The children may invent problems involving basic facts through the 10 group. For complete directions, see Activity 14, page 320.

Helping the slow learner

Determine which problems gave the most difficulty and let the pupils demonstrate the action of these problems, using objects. Then help the children build the equations and justify them by further manipulation of objects.



CHARTING THE COURSE

Number system 1 to 99

A modern arithmetic program for the primary grades helps children learn the basic principles of the number system. Little understanding of arithmetic is possible without this knowledge. Two ideas—namely, *grouping by tens* and *place value*—are basic. The numeral *3* and the word *three* are both used to represent the same quantity. In the symbol 33, the numeral 3 written at the left indicates three groups of ten. The 3 written at the right indicates three single objects. By using the principles of grouping by tens and of place value the quantity called *thirty-three* is represented by using two 3's. Any quantity, no matter how large, is represented in writing by using only the ten numerals, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

Children learn the principles of the number system by seeing, first, how a large group of objects can be organized through grouping by tens. Second, they learn how written records of such groups can be made by using tallies or numerals and the idea of place value. Familiarity with these ideas is essential to understanding arithmetic.

Pupils who have been introduced to arithmetic with materials in the *Seeing Through Arithmetic* program for Grades 1 and 2 should be well grounded in the basic principles of the number system. For children who have not been taught through this program and for reteaching those whose understanding is not complete,* a presentation of the basic ideas of the number system is given on pages 42 to 45 of *Seeing Through Arithmetic* 3. These pages can be used to check up on pupils' knowledge and to review or teach so that all pupils understand grouping by tens and the use of place value.

Attention is directed first to objects grouped into tens and ones, and to the way place value is used in writing the total number. Following this, attention is given to the decade numbers and their names (*ten, twenty, thirty,* etc.) and symbols (10, 20, 30, etc.). Then the *teen* numbers are studied. In helping children with these ideas, the emphasis should be upon the sequential principles through which the decades and numbers within the decades are expressed.

Special attention is given to certain methods of regrouping that will be useful later in learning "carrying" in addition. For example, a total group is shown arranged into two subgroups of 10 objects each and 12 individual objects. This represents "2 tens and 12 ones." The 12 ones are then regrouped as "1 ten and 2 ones." The child can then clearly see that the number of objects is "3 tens and 2 ones"—that is, 32. This regrouping of the "ones" into "tens and ones" is the simplest illustration of the underlying principle of "carrying."

Similarly, the principle of "borrowing" in subtraction is shown by taking apart a group of 10 objects and arranging them with other objects that are insufficient to make a group of 10 (the "ones" of a number). For example, a total group of "3 tens and 8 ones" is shown as "2 tens and 18 ones" by taking one of the groups of ten apart and arranging these objects with the original 8 ones. In short, understanding of carrying and borrowing depends fundamentally upon an understanding of the number system, of the way in which number symbols can represent groupings of objects, and of the ways in which regroupings are made.

On these pages the numbers used are all less than 100. These numbers are not to be taught as individual numbers. Instead the system is to be taught so that the pupil can understand and deal with any particular number by using the principles of the system. A later section on the number system extends the principles taught on these pages to numbers through 999.

*Numbers We See, by Anita Riess, Maurice L. Hartung, Henry Van Engen, and Catharine Mahoney. Scott, Foresman and Company.
Numbers in Action, by Maurice L. Hartung, Henry Van Engen, and Catharine Mahoney. Scott, Foresman and Company.

42-45 Moving forward

Lesson Briefs for this lesson ore on poges 45-47.

Overview

Pages 42-45 develop two ideas basic to an understanding of the number system—namely, grouping by tens and place value. These ideas are developed while children learn to read and write numerals with two figures in them.

On page 42 the child learns how quantities varying from 10 to 99 objects can be organized into groups of ten and ones for purposes of quick counting. They learn, too, the principles of place value in recording and reading these amounts—that tally marks or a number symbol written at the left of the line is used to show how many groups of 10 there are; that tally marks or a number symbol written at the right of the line shows how many ones or single items there are; that the same tally mark or symbol can stand for ones or for tens; and that the place where it is put shows which it stands for. Activities are organized around pictured groups of objects, tally mark spaces, and numerals that must be matched.

On page 43 the children learn the names and the numerical symbolism of the decade numbers (10, 20, 30, etc.). They learn to say these numbers in their proper sequence. They learn both the positional and quantitative meanings of these numbers and the rôle of zero in the ones' column.

The meaning and symbolization of the teen numbers is presented on page 44. And on page 45 this is extended to cover all numbers through 99.

Remember to use the opening and closing statements of the lesson to help children focus on what they will learn and to have them discuss afterward in their own words what they did learn.

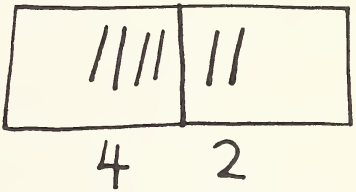
Teaching the whole class

Page 42: By this time children have had many experiences with single objects collected into groups through 10. Now they learn to look at a group of 10 in a special way. It may be considered as a single collection of 1 ten. By counting the number of such collections or groups of ten and any additional ones that are not enough to be assembled into a group of 10, the total number of objects (limited in this work to totals fewer than 100) can be determined quickly.

Before working with page 42 you will want to give the children experiences with arranging undetermined quantities of objects into groups of ten and ones. For this activity, divide the class into several working groups. Tell each group of children that you want them to help you gather a group of single objects into groups of ten. Have available objects that the children can put into bags, bundles, or pyramids. (Examples are crayons, pencils, jacks, peg sticks, tongue depressors, paste sticks, toothpicks, spools, and small blocks.) Assign different objects to each group of children. Try to have varying numbers of objects. If possible, provide as many as ninety or more of one kind. Then have the children work together grouping the objects into tens by bundling them into tens with rubber bands, putting them into bags of ten, or stacking them in pyramid formation. For each kind of object there should be some left over that are not enough to make a group of ten.

When the class has finished putting all the sets of objects into bags or bundles of ten, with some left over, have one group of children bring their objects to a desk or table where all can see. Tell the class that they will learn how to count the objects quickly and how to make a record of how many there are.

On the board draw a tally space (see the picture below). If the children do not know what tally marks are, show them the usual way of keeping track of, or tallying, objects by making a single mark for every object or group of objects counted. Then ask a pupil to come to the board to make tally marks for the groups of objects on the table.



Have the pupil at the board place a tally mark to the left of the center line in the tally space for each group of 10 objects. Then have him make a tally mark at the right of the center line for each of the ones or single items. Then have him count the number of tally marks on the tens' side and write this numeral directly beneath the tally space. Next have him count the single tally marks and write that numeral beneath the tally space on the right side. Tell him to read the result as, for example, "four tens two ones," and say the correct amount.

Next tell the class that later on they will find out how many objects the others have collected, but now you want them to turn to page 42 of their books.

Ask someone to read the "Moving forward" statement. Then direct attention to Picture A. Ask the class how many marbles they think are in each bag. They should accept the fact that each bag contains 10. Ask how many bags of 10 marbles are shown and

how many marbles are not in bags. Be sure the children know that tally marks for tens are put on the left side and those for ones are put on the right side. Tell them to look at the sets of tally marks shown below the pictures to find the set that shows the correct tally marks for Picture A. Call on someone to identify this set of tally marks by its letter (B). Have him explain how he knows this is the set that matches Picture A.

Next tell the class to look at the row of numbers at the bottom of the page (A to N) and find the number that shows for Picture A how many tens and how many ones there are. Right now, of course, it is important that the children think of numbers as composed of tens and ones. However, if a child recognizes this number and says "forty-seven," ask him to explain what the 4 in 47 means and what the 7 means.

Continue in the same way for the other pictures on the page, calling on different pupils to identify the correct tally marks and numerals.

Special attention should be given to Picture C (showing 33 blocks), its set of tally marks (E), and the 33 in the row of numerals. Be sure the children understand that a numeral or tally mark can stand for one thing or 10 things and that the place where each is put shows its value. Ask questions like these:

How many blocks are in each bag in Picture C? How many bags of 10 blocks each are there? How many single blocks are there? One of the sets of tally marks below shows the correct tally marks for this picture. How many tally marks should be made for the 3 bags of 10 blocks each? Where should they be put? How many marks should be made for the single blocks? Where should these tally marks be put? Which set of tally marks shows the correct number? When you look at the tallies, notice that there are three marks in each space. How can you tell which marks mean 3 tens and which mean 3 ones? Now look at the numerals below. Which of the letters shows a numeral that means 3 tens and 3 ones?

After the exercises on the page have been completed, ask one child from each of the groups of children that collected items into tens and ones to come to the board. Have each of these children draw a tally space and make the correct tally marks and numerals to show how many objects his group had. Call on another pupil from each group to check the groupings of the objects with the tally marks on the board and to read the result as "5 tens, 6 ones," etc. If possible, keep the objects that the children have grouped and bundled into tens and ones assembled for the next lesson.

Page 43: In a central location where all can see, place the objects that the children used in connection with the work on page 42. Remove those not collected into tens (the single items). Then ask how many groups of 10 there are in each collection. Draw a tally space on the board. When the child announces how many groups of 10 there are (4, for example), ask him where the tally marks that stand for the pencils, for example, should be put. His response should indicate the left side of the center line. Ask him how many ones there are. The response, of course, should be that there are no ones. Direct him to leave the space to the right of the center line empty. Then have the class count the tally marks at the left, and write this one-figure numeral directly beneath the tally marks. Beneath the empty space to the right place a zero, and tell the class that this zero shows there are no ones.

Tell the children there is another reason why a zero must be put at the right. Then place a 4 immediately under the 4 in 40. Ask the class whether they would know if this figure referred to 4 tens or to 4 ones if they could not see the tally space above. Tell the children that to keep the 4 in tens' place, a figure must be in ones' place, and that since there are no ones, a zero shows that the 4 is 4 tens. Read the 40 as *4 tens, no ones*. Tell the class that it can also be read as *forty*. Directly below the numeral 40 write the word *forty* and explain that this is the way 40 is written as a word.

Next ask the children to look at Picture A in their books. Let them determine that there are 10 jacks on the card. Ask a pupil to tell why the tally mark has been placed where it is, why the tally space is empty on the right side, what the 1 in the numeral below means, and what the zero means. Ask if any of the pupils know the word that stands for this numeral (ten). Point out that this word is written below the numeral.

Continue in the same way with Pictures B to I. Throughout the lesson stress the need of a symbol (0) in the numeral (but not in the tally space) to show there are no ones and to use as a place holder. The children will also be interested in knowing that the ending *ty* suggests tens. Thus eighty means eight tens. Help the children to see the similarity of the tens' names to the ones' names. This will be especially simple in the names sixty to ninety and is also quite apparent in the other names. Twenty is "twin" tens, or two tens, thirty is three tens, forty is four tens, and fifty is five tens. When the children are aware of this similarity, they will find it easy to remember the order of the tens. Be sure the children notice that the decade numbers in the pictures are shown in ascending order from 10 to 90.

Tell the children that Exercises A to G will give them practice in saying the names of the tens in order. Explain that they may use Pictures A to I if they need help in finding which names belong where the wavy lines are. Have them take turns reading Exercises A to G aloud, supplying the missing words. Then direct them to place the letters A to G on their papers in a column and to write the missing number words for each exercise after its letter in this way:

A thirty sixty eighty

B twenty fifty sixty ninety

After they have completed this, tell them to look at the number words in Exercises A to I. Have them take turns reading the words as they are in the book. Then tell them to write in a column the letters that would put the words in order, beginning with the smallest. Tell them to write both the number word and the numeral after its letter. Their papers should look like this:

G ten 10

D twenty 20

I thirty 30

To conclude this lesson, you may wish to return to the objects that the children used at the beginning of the lesson. Focus attention at first on the objects of which there are at least 90. Call on a pupil to count them by tens. Tell him to touch each group of 10 as he counts and to say as he counts, "1 ten, or ten; 2 tens, or twenty; 3 tens, or thirty," etc. Take away a few groups of 10 and call on another pupil to find out how many there are. Emphasize the fact that the words are not names of piles but words that tell "how many." Take away some single objects from one pile of 10 and ask another child to count how many tens there are. He should realize that he cannot count such a pile as a ten.

Page 44: Ask one child to identify the objects in Picture A. Adapt the following procedures as necessary. Direct the children to place sticks in the same groupings as the lollipops in Picture A. (Be sure they understand that the lollipops in the box are a group of ten.) Ask how many sticks they put in the large group and how many single sticks they used.

Then have them look again at Picture A. Ask:

What does the one tally mark on the left side of the tally space mean? The one tally mark on the right? Since there is 1 ten, the figure 1 has been placed in tens' place. What figure has been placed at the right of the 1 to show the number of single lollipops? We can read this number as 1 ten 1 one, or eleven. You will find 11 written as a word underneath it.

Proceed in a similar manner with Pictures B to I. Get the children to notice that all the sets of tally marks are alike in one way: each has only one mark on the tens' side. Associate this 1 ten with the word *teen*, which is a part of all number names between ten and twenty, except for eleven and twelve. Help the children to notice that after twelve the names of the numerals correspond to the number of ones in the numeral. For example, in fourteen there are four ones. Make sure the children observe that the order of the figures in ones' place in the teen numbers is the same as their order in the other decades.

Exercises A to G give the child practice with the sequence of the teens. For these exercises and Exercises A to I at the bottom of the page, adapt the procedures suggested for similar exercises on page 43.

Page 45: The following activity will review the order and meaning of the teens and tens. Pick up and hold before the class in your right hand as you face the class one bundle or bag of 10 objects. Ask how many there are. With the left hand pick up one more of the same kind of object. Now as you face the class ask how many you have in all. If the reply is given as 1 ten 1 one, ask for the name of the number. Then with the left hand pick up another of the same type of object, so that you have 2 in the left hand and a bundle of 10 in the right hand. Ask again for the name of the number of objects you have in all. Continue picking up single objects until 19 have been shown.

As you pick up one more single object with the left hand, so that you have 10 single objects, ask:

How many single objects do I have now? What shall we do with these 10 single objects?

Work for the answer that these 10 single objects should be made into one group of 10. Ask a pupil to come up and do this. (He could put a rubber band around them, put them in a bag, etc.) Then transfer this group of 10 to your right hand and ask how many you now have. The response should be 2 tens, or twenty.

Next pick up a single object with the left hand. Guide the children to say that you now have 2 tens and 1 one, or twenty-one. Repeat the whole activity by picking up ones with your left hand and having the successive numbers named until you have reached a total of 29. As you pick up one more single item with your left hand, ask the class what should be done with the 10 ones. When they have been grouped into 1 ten and transferred to your right hand, ask the class how many you have. The response should be 3 tens, or thirty.

Direct attention to Picture A on page 45. Call on a pupil to identify the objects. Then ask what the 3 in the tally space means and what the 4 means. Be sure the children understand that the 3 stands for the number of tallies that could have been put in tens' place, and the 4 stands for the number of tallies that could have been put in ones' place. Point out the words *tens* and *ones,* written above the tally space. Explain that these words identify the two places in the numeral 34. Tell the class that since 3 tens have the name *thirty*, then 3 tens and 4 ones are read as *thirty-four*. Point out the numeral 34 below the tally space. Have the children say it. Then tell them to look below the numeral to see how the number is written in words.

Proceed in the same manner with Pictures B to F. Emphasize that to find out the name of a two-figure numeral (except for the teen numbers), they should first say the number of tens by name, then say the number of ones.

To make certain the children get a clear idea of the meaning of *all* two-place numbers, it is suggested that the *Arithmetic Readiness Cards, Set 2: The Number System** be used to supplement the work with these pages.

If possible, also show the motion picture *The Number System*** to children sometime during this block of work to reinforce the ideas presented in the book.

The first block of exercises (A to O) should be done orally before the children write the answers. Ask them to read Exercise A silently. Say:

To show the objects that this numeral stands for, how many bundles of ten should I hold up? How many single objects should I hold up? What is another name for eight tens? How many objects would I have in all?

Write the numeral 84 on the board. Use this procedure for the first three problems or so, to insure understanding. Call on children to give oral answers to the other exercises. Those who need to could come up to the table and select objects in groups of ten and ones to see what the numbers mean. If any of the children have trouble writing the numerals, they may draw a tally space, make the correct number of tally marks, and then write the figures that stand for the tally marks.

Next have the children place the letters A to O on their papers. Tell them that, if necessary, they may use the collections of objects on the table to help them decide on the correct answer to place beside each letter.

The second block of exercises (A to O) may be done orally before the children write the answers. Have the children read each exercise silently before you ask one child to read it aloud and supply the answer.

Next instruct the children to write the words *tens, ones,* and *number* at the top of their papers and write the letters A to O in a column, as shown below. Then have them do the work as follows:

	tens	ones	number
A	3	1	31
B	8	3	83
C	6	2	62

Complete the lesson by asking the pupils to read the statement at the bottom of the page.

As a check on your pupils' knowledge of the numbers from 1 to 99, you may ask them to help you make a number chart that shows all the numbers in order. See Activity 15, page 320, for directions. Discuss with the children the arrangement of the chart.

Providing for the able pupil

To reinforce the understanding that the same mark or number symbol can stand for either 1 or 10 and that the place where it is put shows which it represents, the following activity may be tried. After the number 33 (Picture C on page 42) has been studied, the abler pupils might like to prepare drawings, with tally marks and numerals, showing the meaning of

**Arithmetic Readiness Cards, Set 2: The Number System,* by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company. Set of 54 cards in color with pictures on both sides illustrating the numbers to 99 and a few three-place numbers. Also included are tally-mark and number symbol cutouts, to insert in slots of the picture cards, and a teacher's guidebook with suggestions for use.

***The Number System,* eleven-minute sound film in color, available from Encyclopaedia Britannica Films, Inc., Wilmette, Illinois. This film was produced in collaboration with the authors of *Numbers in Action.*

the numbers 22, 44, 55, 66, 77, 88, and 99. For complete details see Activity 16, page 321. When finished, these drawings can be shown to the rest of the class.

Helping the slow learner

Picture cards that show objects grouped in tens and ones and small cards with tally marks and numerals on them may be used in a number of ways to give children more experience in building understanding of two-place numbers. If the *Arithmetic Readiness Cards, Set 2: The Number System* are available, they may be used in place of specially drawn pictures. For suggestions, see Activities 16 and 17, page 321.

46-49 Moving forward

Lesson Briefs for this lesson are on pages 47-49.

Overview

The purpose of the work on pages 46 to 49 is to prepare children for understanding what is involved when they meet carrying in addition and borrowing in subtraction. On these pages they learn that objects grouped in tens and ones and the numerals that stand for them can be regrouped or rearranged without changing their value.

On page 46 the child learns what to do when there are more than 9 ones to deal with (as occurs in addition). They learn to regroup the ones into as many tens as possible. Movie sequences show the original groupings and what happens in the regrouping. Numerals accompany the movies and show the resulting changes in symbols.

Examples for practice on regrouping ones into tens (including situations where there are more than 19 single objects) are provided on page 47.

Preparation for borrowing in subtraction is strengthened by the work on page 48, where movie sequences of objects grouped in tens and ones show the regrouping of 1 ten into 10 ones, and accompanying symbols record the changes in the numeral. Examples for practice in changing tens to ones are provided in the exercises on page 49.

All the concepts presented on these pages will be strengthened if children are permitted to work with objects, grouping them in tens and ones and regrouping them as directed.

Teaching the whole class

Page 46: Ask the pupils if they remember how the objects or pictures of objects were grouped in the lessons just completed. The response should be that the objects were grouped in tens and ones.

Ask the children to look at the first scene of Movie A. By this time they should realize immediately that there are 10 crayons in each bundle. Then ask how many bundles of 10 there are. Ask if this numeral has been put in the correct part of the tally space. Then ask how many single crayons there are and if this numeral has been put in the right place. Then tell the pupils to look at the numerals in the tally space. Ask if these numerals can be read in any other way besides 2 tens and 12 ones. Guide them by questions to see that something should be done with the 12 single crayons. Ask for suggestions as to what can be done. The children may want to use the objects previously grouped into tens and ones to demonstrate or check on suggestions.

Probably someone will call attention to the second scene of Movie A or will demonstrate the activity being shown there. If not, direct attention to this scene. Help the children see that 10 of the single crayons (or ones) are being bundled together to make another group of 10. Ask the children what has happened in the third scene. Ask questions such as these:

How many bundles of 10 crayons are there now? How many single crayons are there? Has the new numeral for the number of tens been put in the right place? Has the new numeral for the number of ones been put in the right place? Can you read the number now? What is it?

Be sure the children understand that the crayons in the third scene are the same as in the first two scenes and that the same number of crayons is shown in each of the three scenes.

Continue in the same way with Movies B to E. Be sure the children are aware of the fact that the middle picture in Movie A (the picture showing the rearrangement of the ones) has been omitted in these movies.

To provide more experience in changing ones into tens, let the children work with objects.

Page 47: Tell the children to look at Picture A and see how many bundles of 10 paste sticks there are and how many single sticks. Then ask them to look at the first line of text in the picture. Call on someone to read it aloud, saying the missing number.

Next ask the children to look again at the picture to see if there are enough single sticks to make another bundle of 10. Ask how many bundles of 10 paste sticks there would be then, and how many single paste sticks would be left. Call on another pupil to read the second line aloud and supply the missing number.

If the children have trouble understanding how the 10 ones are made into a group of 10, use objects to demonstrate the situation in Picture A. Then have a child bundle up 10 single objects and put them with the other bundles of 10.

Picture B introduces the idea that there may be enough single objects to make more than one group of 10. Use objects to duplicate the situation in the picture. Ask first how many tens there are and then how many single objects. Call on a pupil to read aloud the first line of text. Then, using objects, have someone group the single objects into tens. He should see that the single objects will make more than one group of 10 and should then gather enough single objects to make two groups of 10. He should put these two groups of 10 with the other bundles of 10 objects. Ask him to tell how many bundles of 10 he now has and how many ones. Then tell the class to look at Picture B and imagine the 22 single objects grouped into two more groups of 10 that can be put with the tens already there. Ask how many ones will be left. Then ask someone to read the second line of text, saying the missing number.

With Pictures C and D, get the children to imagine the regroupings without the use of objects, if possible, as a step toward the examples for practice that follow. If the children have trouble imagining these regroupings, ask questions like these after they have determined how many ones there are to begin with:

In Picture C you say there are 27 single marbles. Twenty-seven is how many tens and how many ones? [*2 tens and 7 ones*] *Now what should you do with the 2 tens? How many tens will there be in all, then? How many ones will be left? Read the second line, saying the missing number.*

Exercises A to X should be done orally at first, with the children taking turns saying the missing numbers. They should understand that the first line in each exercise tells them what a picture with objects would show. For the second line they must think of the ones as regrouped into tens so that fewer than 10 ones will remain. The children who have difficulty may use objects to find the correct answers. The average and above-average children should be able to do their thinking without the help of objects. Always encourage them to try to answer without using objects.

For Exercise A, for example, when a child reads 12 ones, he will remember from previous study of the number system that 12 is equal to 1 ten 2 ones. Then he will put the 1 ten with the 8 tens to get the new number of tens.

When the exercises have been completed orally, instruct the children to write the letters A to X in a column on their papers. Tell them to write the headings "tens" and "ones" for two columns at the right. Underneath these headings they should fill in the missing numbers for each exercise. Their work will look like this:

	tens	ones
A	9	2
B	6	4

Page 48: Procedures for page 48 can be similar to those for page 46. In discussing the movies, children should note the grouping of tens and ones in the first scene of each movie and decide whether or not the figures below it are correct. They then should note that one of the groups of 10 objects has been opened and put with the single objects.

The new grouping of tens and ones can then be counted, and the new figures in the tally space should be noted. The children should understand that these new groupings of tens and ones represent the same amount as the numerals under the tally spaces. As with page 46, the children may work with objects to gain concrete experience with the regroupings, if necessary.

Page 49: The procedures used for page 47 may be adapted for this page. Instead of changing ones into tens, however, the children now change a ten into ones. From the pictures and Exercises A to G they should begin to notice that it is never necessary to change more than one group of ten into ones.

For the second block of exercises (A to Q), the slow learners will probably need to use objects. They also may need to make a record of the number of the original tens and ones before they make a record of the regroupings. The average and above-average pupils should be able to handle these exercises without using objects. They will think of the original number as so many tens and so many ones. Then they will see that in each exercise the number of tens in the original number is reduced by one as one group of ten is thought of as being put with the ones. In their study of the number system they learned to think of a group of ten and some ones as a "teen" number; so they should be able to think immediately of the "teen" number that results.

Finish the work by having the children read and comment on the concluding statement at the bottom of the page.

Providing for the able pupil

After the children have completed the lesson on page 49 (changing 1 ten to 10 ones), the able children might enjoy taking various numbers, such as 99, 87,

76, etc., and finding all possible ways to rewrite such numbers in terms of tens and ones without changing their value. For complete details on this activity, see page 322, Activity 19.

Helping the slow learner

These children need many experiences involving regroupings. One way to give them more experiences is to let them have number system spelldowns. See Activity 20, page 322.

50-51 Using arithmetic

Lesson Briefs for this lesson are on pages 50-51.

Overview

On pages 50 and 51 the child meets the first "Using arithmetic" lesson in the book. Fourteen simple problems involving addition, subtraction, multiplication, and division are presented. Children are expected to make the equations and find the answers. For the problems on page 50 the pattern for each equation is set up. In each equation a wavy line indicates that the correct sign (+, −, ×, ÷) must be supplied, and a screen (▤) indicates where to put the missing number. The problems on page 51 do not provide skeleton equations. Children must build the entire equation, based on the information obtained by them from the problem.

Teaching the whole class

Page 50: Remind the children that just before they did the work on two-figure numbers, they had a lesson on using addition, subtraction, multiplication, and division in problem solving. Say:

Do you remember that you learned to write the numbers and the sign you needed to describe a problem by an equation? In this lesson you will have a chance to make equations and solve problems.

You will probably find it advantageous to review the meaning of addition, subtraction, multiplication, and division before the children try the problems on pages 50 and 51. To do this, you might make up a problem to illustrate each process, asking the children to tell you what process the action in each situation makes them think of. Then encourage the children to make original problems and illustrate them, either by acting them out or by using markers.

Emphasize that addition involves one group joining another group, in subtraction part of a group is removed, in multiplication several equal groups are combined, and in division a group of objects is separated into groups of equal size.

Have the children read the first two sentences in Problem A. Provide opportunity for various children to give their ideas about what is happening in Picture A. Then tell the children that to find the answer for this problem they must make an equation. Use specific questions, such as the following, to help the children express the action in the picture in the form of an equation.

How many children were at the table to begin with? How many are leaving the table? What sign should you use to show that some children are leaving the table? What numbers will you use to make the equation? Where will you put the 6? The 3? Look at the last line of Problem A. What should you put in place of the wavy line? Jane, read the equation, saying the right sign and the number that the screen is hiding.

Proceed in a similar manner with Problem B and its picture.

There are no illustrations to help the children solve the problem situations described in Problems C to H. They must depend entirely upon their own ability to visualize the action. Have each problem read silently before one child reads it orally and completes the equation.

This lesson is continued on page 51.

Page 51: For Problems I to N the children must make the equations entirely on their own. Work Problem I with the class, putting the equation on the board. Then have the class write the equation for each of the remaining problems twice, first with the correct sign inserted and a screen (a □ will do) in place of the answer, and then with the answer written in place of the screen.

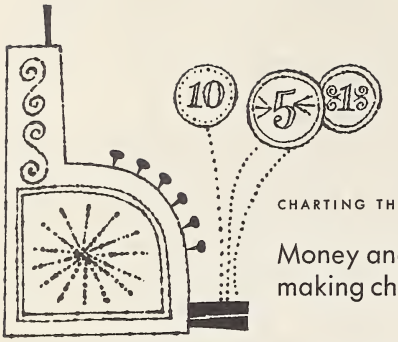
If there is time, assign the "Keeping skillful" exercises at the bottom of the page as written work. Otherwise, keep this practice work for another time. Tell the children to letter three columns on their papers: A to P in one column, A to H in another column, and A to U in a third column. In the first two columns they are to write the numbers that belong where the screens are. In the third column they are to write the answers.

Providing for the able pupil

Activity 14 on page 320 may be used in connection with the lesson on pages 50-51. Limit the work to problems for groups not exceeding 10. Tell the children to be alert for problems made by the others that involve more than ten objects.

Helping the slow learner

Activity 14 on page 320 may be adapted to the needs of slow learners. Give pupils equations and let them use objects to set up a problem situation suggested by the equation. Have the children complete the action by working with the objects if necessary. The objects may be any reasonably small items available.



CHARTING THE COURSE

Money and making change

By the time children have reached Grade 3 they should be able to recognize and name the penny, nickel, dime, and quarter, should know their relative values, and should be able to count small amounts of money. *Seeing Through Arithmetic 3* provides materials on pages 52-58 to check up on this knowledge and extend it. These pages deal with counting amounts of money up to 99¢ and making change, using the penny, nickel, dime, quarter, and half dollar.

Although our monetary system is based on the decimal number system, money has some special features of its own. In particular, money involves grouping by *fives* as well as by tens. The nickel is equal in value to five pennies, the quarter to five nickels, the fifty-cent coin to five dimes. These relationships are used in counting money and in making change. In *Seeing Through Arithmetic 3* the importance of grouping by fives in counting money and in making change is given special attention.

In *Seeing Through Arithmetic 3* the knowledge that children are supposed to have about money is not used as a basis for teaching the principles of the number system. On the contrary, the principles of the number system are introduced first and are then applied to learning situations involving money. The monetary system does not provide an appropriate basis for teaching the number system because, since it involves grouping by *both* fives and tens, it is really more complicated than the number system.

The important problem of making correct change, or of checking to see if the correct change has been received, is similar to counting money. It involves additive thinking, and is a process of counting upward from the amount owed to the amount paid. It is, of course, true that the correct amount of change can be calculated by the process of subtraction, but this is not the way change is commonly made in actual practice. In *Seeing Through Arithmetic 3* change making is taught in the way it is most frequently met in actual situations.

52-55 Moving forward

Lesson Briefs for this lesson ore on poges 52-54.

Overview

Pages 52-55 teach children the equivalent money values for the nickel, dime, quarter, and half dollar. In using money, pupils also learn to count by fives, tens, and twenty-fives in a meaningful way.

The relationships among the coins valued at 10¢ and less are shown in pictures on page 52. Also presented here is a chart with the numerals 1 to 50 arranged consecutively. Every fifth numeral is in red. By working with these red numerals, children can get a better idea of how counting by fives includes all the numbers not named in the counting. The red numerals ending in zero can be used in the same way for counting by tens. Circled numerals indicate what counting by twenty-fives means.

Page 53 develops the equivalent money values for the quarter and half dollar. Pictured collections of coins give children practice in counting total values of coins by fives and tens.

Pages 54-55 continue the counting activity introduced on the preceding page as children get practice in counting amounts of money less than one dollar.

You will want to give children some experiences in actually handling and working with real coins, if at all possible.

Teaching the whole class

Page 52: Tell the children that this lesson will be about something they have not yet studied in this book. Direct them to examine the page for a few moments and then to read the "Moving forward" statement on page 52 to find what this new topic is. Have one child read the statement orally. Then ask:

What coins will you learn about on this page? [*pennies, nickels, dimes*] *Have you had a penny, a nickel, or a dime to spend recently? What did you buy?*

Jot down the things the children name to use for questions at the end of the lesson.

Then proceed in a manner similar to the following:

Look at the numerals in the chart at the top of the page. How many are there? Notice which ones are shown in red. What is the first red numeral? How many more do you have to count before you

come to another red numeral? Now count five more numbers. What color is the numeral you stop at? What is the name of the third red numeral? How many more do you have to count before you come to another red numeral? What is that numeral? Look ahead at the red numerals. Do you see that every time you count five numbers you come to a red numeral? You can see that every fifth numeral is red. John, read each red numeral. Is this a shorter way of counting to 50 than counting by ones? What do you think we call this kind of counting? Do you see that when you count by fives you must know that other numbers come in between the numbers you name?

Next ask a pupil to count by tens, putting his finger on each numeral he names. Call on one of the better students to count the first row by fives and then to go on counting by tens. Tell him to put his finger on each numeral as he names it. Ask him the name of the last numeral he touches.

Next put 50 pennies (heads up) in rows on a table or desk, arranged like the numerals in the chart. Ask a child to count the pennies by ones. Then call on another pupil to turn over every fifth penny. If he cannot do this easily, ask him to count "one, two, three, four, five," and turn over the penny that is number five so that the "tails" side is up. Tell him to keep repeating this until he has turned over every fifth penny. Now ask another pupil to count the pennies by fives, using the pennies with tails side up to guide him.

Have some children stack the pennies in piles of 5. When they have been stacked and arranged in one long row, ask another child to count the stacks by fives to find how many pennies there are.

Then tell the class that each stack of pennies can be replaced by one coin called a nickel. Tell them that one nickel is equal to, or worth, 5 pennies, and that another word to use instead of *penny* is *cent*. Explain that 5 pennies is the same as 5 cents. Write the cent sign (¢) on the board. Then say that the nickel is worth 5 cents. Supply some nickels and let some of the children put a nickel beside each stack of 5 pennies. Point to different nickels and ask how much each is worth in pennies or cents.

Next tell a pupil to move two stacks of 5 pennies together. Ask him how many pennies there are now altogether in the group. Tell the class that 10 pennies and 10 cents mean the same. Ask the pupil to continue putting two groups of 5 pennies together. Ask another child to move the nickels together in groups of two, so that each group of 2 nickels is opposite a group of 10 pennies. Tell the class that 2 nickels are equal to, or are worth, 10 pennies, or 10 cents. Point to different groups of 2 nickels and ask their value in cents.

Next tell the class that a dime can be used to replace 10 pennies and also 2 nickels. Tell the children that the dime is also worth 10 cents. Have them put a dime beside each group of 10 pennies and each group of 2 nickels. Point to different dimes and ask their value in cents. Point to individual groups of 10 pennies and individual groups of 2 nickels and ask their value in cents.

Now direct attention to Picture A. Ask the children how much the little airplane costs. Tell them to look at the pictures of money below the picture of the toy. Help them discover that they can use either the 5 pennies or the nickel to buy the airplane. Be sure the children understand that "nickel," "5 cents," and "5¢" all represent the coin shown in Picture C.

Then tell them to look at Picture D and see how much the truck costs. Ask them what coins can be used to pay for the truck. Help them to see that the coins in Pictures E, F, G, and H are all equal in value and that each picture shows enough money to buy the truck. Bring out the equivalent meanings of "dime," "10 cents," and "10¢."

Finish the work with this page by naming the things the children said they bought for a penny, nickel, or dime at the beginning of the lesson. Ask if they could have bought the nickel items for five pennies or 5¢. Then ask if they could have bought the dime items with pennies or nickels. Ask how many pennies and how many nickels would have been needed.

Page 53: Direct the children to look at Picture I. Ask a pupil how much the book costs. Then ask another pupil to count the pennies in Picture J to see if there are enough pennies to buy the book. If he starts to count the pennies by ones, remind him that it is easier to count by fives. If he says that there are 25 pennies, ask him what another word for pennies is, and lead him to say "25 cents."

Next call the children's attention to Picture K. When the coins have been identified as nickels, ask how many cents each nickel is worth. Ask the class to find out how many cents there are altogether in Picture K. They should count by fives, and the total should be 25 cents. Be sure the children understand that when they count 5, 10, 15, etc., they mean 5¢, 10¢, 15¢, etc. Ask a pupil if the five nickels in Picture K can be used to buy the book in Picture I.

Next have the class look at Picture L. Identify the coin as a quarter, and ask how much a quarter is

worth in cents. If no one knows, tell them the coin's value. Then ask if the quarter can be used to buy the book in Picture I. Point out that "quarter," "25 cents," and "25¢" are different ways of identifying the same coin.

Direct attention to Picture M next. Ask a pupil how much the dishes cost. Then ask how many pennies there are in Picture N and whether there are enough to buy the dishes. Continue with the same type of questions that you used with Pictures I to L.

To reinforce the ideas presented in Pictures I to R, it would be well to use real coins and line them up beside each other according to values of 25¢ and 50¢, much as was suggested for the work with page 52. Stress the equivalence of the values you set up for the quarter and half dollar.

As the children work with real coins and the pictures of coins, they should begin to see that 5 nickels equal a quarter; 10 nickels, 50 cents; and 5 dimes, 50 cents. They should realize that it is not necessary actually to count by fives or tens each time.

The coins in Pictures S, T, U, and V may be counted in the same way. (See "Helping the slow learner" for details.) Coins that are overlapped in the pictures should be counted as a single unit. For example, two of the nickels overlap in Picture T, and they should be counted as 10 cents. Teach the children to begin counting with the coin of the highest value.

Page 54: Tell the children to open their books to page 54. Then proceed with such directions as:

What coins do you see in Picture A? Each quarter is worth how many cents? If each coin has the same value as 25 pennies, you can count them by twenty-fives to find how much the three coins are worth in pennies. Look at the number below the first quarter. What does it say? Do you remember the value in pennies of two quarters? What is it? Look at the number below the second quarter. What is it? Look at the number below the third quarter. What is it? Read the numbers silently to yourself as you point to each coin above the numbers. Will the three quarters buy as much as 75 pennies? What is another word to use instead of pennies? *Three quarters are worth, or are equal to, 75 cents. Find this written somewhere in Picture A. Notice that the cent sign is not put at the right of the numbers under the quarters. You say "cents" only when you have finished counting the coins.*

Use similar procedures with Pictures B to D. In Pictures E to N the child must do his own counting. Use these exercises orally first.

Page 55: Have the children work through Exercises O to X orally, following the procedures outlined for the preceding page. Then have all the children write the letters E to X in columns on their papers and write after each letter the total amount shown in the picture. They should arrive at the amounts by counting the money. (Exercises E to N are on page 54.)

For the work at the bottom of page 55, tell the children that they have learned several facts about money, and that now they will have a chance to use these facts in writing answers to some exercises. This will help you to find out if some of the children need more help in understanding the money equivalents they have been studying.

Have them place the letters A to R on their papers and write the answers that belong where the screens are. When all the children have finished, have various ones take turns reading the exercises and giving their answers. If some of the children have trouble, supply coins, if possible, and let them manipulate these coins to find their answers.

To conclude the lesson, ask a pupil to read the statement at the bottom of page 55.

Providing for the able pupil

Have the able students see how many ways they can make up specified sums of money under a dollar. They should use different combinations of half dollars, quarters, dimes, nickels, and pennies. For this activity, cards with objects and prices on them should be prepared. See Activity 21, page 323, for complete details.

Helping the slow learner

All the equivalent possibilities for a quarter and a half dollar are not shown on page 53 of the pupil's book. A useful and interesting activity would be to let children use real money and find for the quarter and half dollar as many equivalent combinations as possible. This activity should be carried out before the exercises on page 55 are assigned.

Children who have trouble counting the money shown in Pictures S to V on page 53 may be given real or play coins in the denominations shown in the pictures to use in connection with the chart at the top of page 52. For example, for Picture S the child would first place a quarter on the red 25 in the chart. (Warn the children to hold their books flat.) Next he would take a dime, count 10 beyond the 25, and place the dime on the red 35. He then would repeat this procedure for the second dime, ending with 45, which is the total of the money shown in the picture. If several children have trouble counting money, it will pay to make a large cardboard chart like the one on page 52. Then provide practice exercises like

those in Pictures S to V on page 53 and let the children take turns using the chart to count the money. Suggest that they start counting with the coin of the highest denomination.

56-58 Moving forward

Lesson Briefs for this lesson are on pages 55-56.

Overview

On pages 56-58 children learn how to make change, using pennies, nickels, dimes, and quarters, for amounts less than $1.

On page 56 objects for sale are pictured. Their price tags are shown and also the coins offered in payment. Beside these are pictured coins that might be given as change, with numerals over each to show what is said as the change is given. Coins already given are dimmed off. Similar pictures appear on page 57, but after the first two exercises children must supply what is said as each coin is given. On page 58 children are directed to draw the coins that might be given as change for pictured situations and verbal problems.

Work with these pages should be supplemented, if possible, by activities with real or play coins, as noted in the teaching suggestions that follow.

The social theme for the lesson is "Toys that might be found for sale in a toy department." Let class members describe their own experiences in shopping for toys.

Teaching the whole class

Page 56: Tell the children that today you are going to let them pretend they are storekeepers. They will have toys to sell, and they are going to learn how to make change for the money presented to pay for the toys.

Ask the children to open their books to page 56 and to look at Picture A. Ask a pupil how much the crayons cost. Tell the class to look at the circle labeled 25. Tell them that it represents the coin a child has to buy the crayons with. Ask how much it is. Then ask the pupils to pretend that a person has handed them this coin to pay for the crayons.

Ask pupils next to look at the circles at the left. Tell the children to pretend that the circles labeled 1 are pennies that they use to make change. Ask them what the circle labeled 10 stands for. Show them that in making change they should begin counting with the price of the article, counting on until they reach the amount presented in payment. Ask again how much the crayons cost and direct attention to the first penny laid down. Ask what number is printed above it. Then go on somewhat like this:

This penny is the first coin you should give as change. It is one cent more than the 12¢ you start with. Twelve cents and one more cent are how many cents? As you give the penny to your customer, you should say "thirteen," meaning 13¢.

Look at the second row of coins. Think of this row of coins as the second scene of a movie. The first penny is dimmed off. It stands for the penny you have already given your customer and counted. You can skip it now, but, of course, it is there. How much is the second coin in this row worth? What number is printed above it? How many cents have you counted so far?

Look at the next scene or row of coins. How many coins are dimmed off? What do they stand for? The third coin represents the amount you are giving back now. How much is it? What is the number above it? This is the number you would say when laying down this coin. What does it mean?

Look at the last scene or row of coins. What coins are dimmed off? Why? What is the name of the coin you are giving the customer now? Up to now you have counted to 15. But you must go to 25¢, which is the amount the customer gave you. Will a dime do this? What do you say as you hand the customer this coin? Is that what is written above the coin? Notice that this time you also say the word cents *after the number. It was not necessary to say it while you were still counting coins.*

It might be well to repeat this activity with real coins or play money, which the children can make. They will profit if they go through the motions of making change and saying the amounts. They will need at least 1 half dollar, 3 quarters, 2 dimes, 1 nickel, and 4 pennies. If the children are to make play coins, a six-inch square of oaktag for each child will be large enough. Provide several real coins of each amount and let the children take turns using them as patterns. As the children finish drawing around each coin, they should write the equivalent value in cents on the paper coin. Then the coins should be cut out. They can be used with the work on pages 57 and 58, too. Then go on by saying:

Let's all count the change for the crayons. Remember, you begin by saying the cost of the article. Pretend that you are giving the box of crayons to a customer and say "12" for its cost as you hand the box to him. What coin should you choose next? Pick it up from your pile and put it on your desk. What should you say as you do this? Pick up the next coin you need. What should you say as you put it down with the first penny? Pick up the next coin you need. What should you say? Pick up the

last coin you need. What should you say as you put it down? Remember to say the word cents *after you put down the last coin.*

Use a similar procedure for Pictures B to D. The play coins may be kept for future use.

Page 57: Direct the children to look at Picture A. Ask questions similar to these:

How much does the puzzle cost? What coin did your customer give you? Use your play money (or real coins) to show how the change should be counted. Look at the book to see which coin is put down first. What do you say for this coin? What do you say for the next coin? And the next? How much is the next coin worth? Why is this coin put down? What do you say for it? What coin do you need to reach 50¢, which is the amount your customer gave you? What do you say as you put the last coin down?

Describe a realistic buying situation involving some item that costs approximately 27¢. Let two children dramatize the buying and selling action, using real or play money. Continue:

How much do the jacks in Picture B cost? What coin has your customer given you? Let's count his change. Remember that you always say the amount of the purchase first. How much is that? What coin is put down next? Why is this coin used? What should you say as you put this coin down? Notice that the picture shows you what coin to put down next, but it does not tell you what to say. You have just said "fifteen." What amount do you want to reach? What coin will bring you to this amount? Is that the coin the picture shows to be used? What should you say as you put the coin down?

Have this situation dramatized, too, with real or play money.

Picture C does not give any help in counting the change. Help the children see that the customer gave 55¢ in coins, and that they are to start counting with 49¢, the price of the boat. Although the picture shows that a penny is the first coin used in counting the change, it might be well to ask what coin will take them from 49¢ up to a money value that is easy to work with. They should see that a penny will bring them to 50¢. From there they can see that they need only 5¢ more to make the amount given, 55¢.

Pictures D to K may be treated in the same way. Provide opportunities for different children to dramatize what is happening in each picture.

Page 58: Tell the children to read the directions at the top right on page 58. Say:

What are you told to do? Let's do the work for Picture A together and use real money. We will draw on the board the coins used in making change. Look closely at what is shown in Picture A. Perhaps you can make a story problem about the buying that takes place. What question will you ask yourself when you have made the problem? [*What coins should be given as change?*]

Let a child tell his story problem before proceeding. Then say:

How much does the ball cost? How much money was paid to the clerk? What coins will be needed to make 55? Why is it best to count the change first to 55?

Have a child use real pennies and count this part of the change for the class. Have a child draw the 4 pennies on the board as the other child counts them. Continue with:

You have counted the change to 55, and you want to make change for 60¢. What one coin can you use to make 60¢?

After he says "a nickel," have him pick up a nickel and say "sixty cents." Have a child draw a nickel on the board. Let the other children watch and see that the coin is drawn properly and the amount indicated in the circle. Review what was said as each coin was counted, and under each coin write what was said.

Use the same activity with Picture B. Then tell the children to go on with Pictures C to G, drawing on their papers the correct coins (each labeled with its proper denomination) and writing under each coin what they would say as they make change.

When all have finished, ask some children to put their work for a specific exercise on the board. Have the rest of the class check their work.

Ask the children to look again at page 58. Tell them that next they will have some story problems to read silently. To help the children understand what to do, have them read Problem H. Ask one child to read it aloud. Ask:

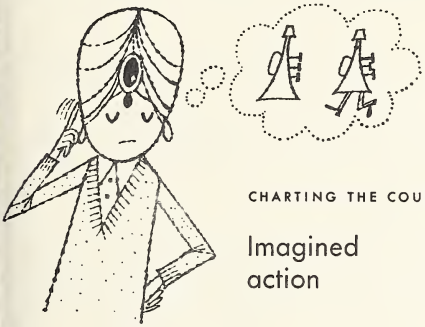
What question could be asked about this story? [*What coins could the man give Don as change?*] *Use play money to decide what coins to use in answering your question.*

Ask various children to tell what coins they chose. Have them count the change aloud. Then have each child draw the coins for each problem from I to S, labeling the coins as they did for the activity above. Instruct the children to write under each coin the number they would say as they make the change.

When all have finished drawing their coins on paper, have various children place on the board their solutions for different exercises. When different solutions for a problem are mentioned, let each child explain his solution, using real or play money.

Providing for the able pupil
More practice in making change, similar to the type of activity carried on with Pictures A to G on page 58, may be provided. For this, 4″ x 6″ cards should be prepared, on which are drawn toys, price tags, and coins paid for the purchase of the toys. For a complete description, see Activity 22, page 323.

Helping the slow learner
The activity above may be adapted to the needs of slow learners by using only the cards with easy situations on them.



CHARTING THE COURSE

Imagined action

In arithmetic textbooks the conventional form for verbal problems is a short paragraph that includes the question to be answered. In *Seeing Through Arithmetic 3*, this form is introduced on pages 37-41, 50-51, and 59-60. The problems that have come before have provided a gradual but definite build-up to this conventional verbal or "story" problem.

The teacher should remember that the paragraph is only a verbal description of the problem situation. In many cases problem situations in life are met and solved without ever being stated formally as a "problem" in conventional paragraph form.

The first 60 pages of *Seeing Through Arithmetic 3* have introduced all the basic facts for groups of 10 or fewer. The situations used to teach these facts have emphasized objects that moved or were moved. The same is true of the situations used to give experiences in problem solving. This emphasis is necessary to establish the basic ideas of combining action and separating action that underlie addition, subtraction, multiplication, and division. These processes are, however, used in situations in which objects are immovable. Attention will now be directed to such situations.

Pages 61-63 of *Seeing Through Arithmetic 3* emphasize the idea that objects that are not easily movable may be combined or separated *mentally*. One may, for example, find the total number of trees when some are in one field and some in another. Similarly, one may imagine that part of a group is removed. The term *imagined action* will be used hereafter to refer to such situations.

Imagined action may come into play not only when the objects themselves are not movable, but also when they are movable. Sometimes the objects in a problem situation are so numerous or so widely dispersed that actually combining them physically would be very laborious and time consuming. Suppose, for example, we want to know the total number of cows in Wisconsin and in Texas. All these cows could be gathered into one group and then counted, but it would be a very difficult job. Nevertheless, the action of combining them can be imagined, and the numerical result can be found easily by using the number symbols.

Situations involving imagined action are used in *Seeing Through Arithmetic 3* to teach some of the basic facts for groups larger than 10. The new concept is also systematically introduced in problem-solving situations. Most of the quantitative problem situations in life would be very difficult or even impossible to solve if people were forced to use the objects themselves. By substituting number symbols for quantities of actual objects, arithmetic makes problem solving much easier.

59-60 Using arithmetic

Lesson Briefs for this lesson are on pages 57-58.

Teaching the whole class
Page 59: Tell the children that on this page they will find some problems that they can solve by making equations.

Ask the children to look at Problem A first. Ask them to read the first sentence silently and then look at both scenes of Movie A to see what has happened. Have the children read the first question silently. Call on one of them to read it aloud and answer it. Continue in the same way for the rest of the questions in Problem A.

Direct attention to the partially built equation below the problem. Ask what the 3 stands for and what the 2 stands for. Ask the children what process Movie A makes them think of—adding, multiplying, subtracting, or dividing. Ask them what sign stands for multiplying. Ask them where it should be put in the equation. Let them tell what number should be put in place

of the screen. Have a child write the completed equation on the board.

Next have the children look at Problem B. Point out that there is no picture to help them. Ask them to read the problem silently; then call on a pupil to read the whole problem aloud, omitting the equation.

Ask the children to imagine what happened and to decide what process the action makes them think of. Let them decide what sign should be put in place of the wavy line in the equation. Ask what number belongs in place of the screen. If any of the children seem to be having trouble visualizing the problem situation, tell them to use objects and act out the story. Continue with the remaining problems in the same way.

This lesson is continued on the following page.

Page 60: Before having the children write the equations and answers to the problems on this page, have them look at Problem I. Let them read it over silently. Then call on a pupil to read it aloud. Have one of the children write the equation on the board as you ask questions similar to these:

How many plants did June have altogether? What did June do to the plants? How many plants were in each group? What will you do to get the answer? Why? What number should you write first in the equation? What sign should you use to show dividing? Where should you put this sign? What number should you write next? What sign do you write next? Now put the screen after the equals sign. Is the equation set up right? What number belongs in place of the screen?

Have another child rewrite the equation, this time replacing the screen with the correct answer. Tell the children that for Problems J to R they are to write the complete equations with answers.

For the work at the bottom of the page under the heading "Keeping skillful," have the children write the letters A to V twice in columns on their papers. Tell them that for this work they need only write the answer to each equation after the correct letter.

Providing for the able pupil

Activity 14 (see page 320) may be used again here. Be sure that none of the invented problem situations exceed the range of processes or basic facts taught thus far.

Helping the slow learner

You may adapt Activity 14 for the slow learners by writing equations for troublesome basic facts on cards and letting pupils use objects to show situations suggested by these equations. For slow learners, there should be no time restriction for the activity. Let each child have enough time to think over the problem without becoming tense or nervous.

61-63 Exploring problems

Lesson Briefs for this lesson are on pages 58-60.

Overview

In many additive and subtractive situations, real action is not feasible and may even be impossible. To solve such problems and see their meaning, action must be imagined.

Page 61 illustrates imagined action for addition. In one case (trees), the groups cannot be put together; in the other (cars), it might not be desirable to join the groups. The pictures show how in each case the groups can be imagined as joined.

Page 62 is a comparable page for subtraction. Here the dimming-off technique is used to indicate the group that is imagined as being taken away.

The work on page 63 provides independent practice on problem solving that involves imagined action. The section headed "Keeping skillful" provides further practice on making change.

Teaching the whole class

Page 61: To start this lesson, tell the children that up until now all the problems they have solved have been about objects that moved or that could be moved. You might have them look at pages 37-41 and pages 59-60 to see that this is so.

Next help them to see that there are situations in which it is necessary, for example, to find how many there are in all, but that it is impossible or undesirable for the groups of objects actually to move together into one group. To illustrate such a situation, you might say:

Alice, how many dolls do you have? Jane, how many do you have? Would you girls have to bring the dolls to school before we could find out how many you have together? Can you imagine that Alice's dolls have been put with Jane's dolls? Can any of you think of other examples where you might want to find how many there are in all and yet it is unnecessary or impossible to join the two groups? How about the pennies Dennis has and the pennies Jerry has? The plants in Room 305 and the plants in Room 302?

Have your pupils turn to page 61. Ask them to read the first four lines of Problem A and direct attention to Pictures A and B. Make sure the children understand that Pictures A and B represent the trees in two different yards. Have the last five lines of the problem read. Point out that Picture C shows how the children might imagine the four trees in Picture B joining the five trees in Picture A. Have them look at the equation in Line 4. Ask them what the 5 stands for, what the + sign stands for, what the 4 stands for. Then ask

someone to read the last line aloud and to say the correct answer in place of the screen.

Next ask the children to imagine the 5 trees in Picture A joining the 4 trees in Picture B. Ask what the equation would be then, and have a child write it on the board [4+5=▒]. Ask what the answer would be. Have them read the problem again and look at the three pictures. Tell them that in problems of this kind, they can imagine that either of the two groups joins the other group. They should use the equation that fits what they imagined. Problem B and its accompanying picture, D, should be treated in the same way. Be sure the children realize that the equation 5+3=▒ can also be used to solve this problem.

Page 62: In the problems and pictures on page 62 the situations are subtractive, but the action has to be imagined. The children must imagine that part of a group is gone. To help them in this imaginative step, the group with which they are not concerned in the end—which they must imagine as "away"—is dimmed off in the pictures. For example, in Problem A, page 62, the number of peach trees is to be found. There are 7 trees, of which 4 are apple trees (see Scene 1, Movie A). Since we do not want to know anything more about the apple trees, the children are to "imagine" them as gone (in Scene 2 of Movie A they are dimmed off). Then the children can see from the picture what remains. From the action imagined, the children will know that this is a subtractive situation and will know what kind of an equation to make to solve the problem. For Problems B to D, have the children read each problem and study its accompanying picture. The dimmed-off portion of each picture should indicate the group that is imagined as gone and thus should suggest the subtraction equation. Have the children make equations for Problems C and D. This work is continued on page 63.

Page 63: The problems at the top of page 63 (E to L) involve either addition or subtraction. The children are to determine from the situation whether the joining or separating of groups is involved. Discuss Problems E and F with the children and have a child write the equations on the board. Then assign Problems G to L as independent written work. The children are to write each equation first with a screen. Immediately below, each equation should be rewritten with the correct answer inserted. Tell them that for some of the problems they have a choice of equations, but they need to write only the one that fits what *they* imagined as happening.

The "Keeping skillful" exercises that follow provide practice in making change. Have the children write the letters A to G on their papers. After each letter, they are to draw the coins they would use in making change for that exercise. They should label each coin with its denomination and write under each coin the number they would say as they make change. Be sure to let the children discover for themselves that there may be several ways of making the change. For example, in Exercise A, one child might use 3 pennies and 2 dimes. Another child might use 3 pennies, 2 nickels, and 1 dime. Review the procedures described for page 58, if necessary.

Providing for the able pupil

Let the abler pupils make up problems that involve imagined action in both addition and subtraction. Watch to see that they use no basic facts with sums or minuends that exceed 10. Encourage the children to use ingenuity in the settings for their problems. You may wish to put some of these problems on the board. Later they may be copied and displayed on the bulletin board.

Helping the slow learner

Write on the board six very simple problems involving imagined action. (You may want to use some of the problems suggested by the abler pupils.) Tell the children to make marks on their papers to show the size of the two groups in addition and the size of the total group in subtraction. Then, for addition, they should draw a ring around both groups to show the imagined joining action and write below or beside the ring the number that shows the total. For subtraction they should draw a ring around the group that is thought of as gone and write the number that shows the result.

CHARTING THE COURSE

Addition and subtraction 11 group

Meaningful learning of the addition basic facts with sums from 11 to 18 involves experiences in regrouping. For example, when a group of 8 objects and a group of 5 objects are combined, the total set of objects can be regrouped into a group of 10 and a group of 3. The child can then easily see that the total group contains 13 objects. Since many children have not had enough ex-

periences in recognizing large groups, *Seeing Through Arithmetic 3* provides, on pages 64 and 65, experiences in recognizing a group of 10 within a larger group containing as many as 18 objects.

These experiences in regrouping lead to the ability to deal with the addition and subtraction basic facts for groups from 11 to 18 in written form. In the past, children have often memorized these addition and subtraction facts with little or no experience which related the facts to real situations. Even when real objects were used, the experience was quite commonly confined to counting. For example, if groups of 8 and 5 were to be combined, the child was told to start with the 8 group and continue the counting with the members of the 5 group, saying "nine, ten, eleven, twelve, thirteen." No direct use was made of the idea of reorganizing the groups and of the principles of the number system.

As noted above, if a group of 8 and a group of 5 are to be combined, the total group may be reorganized into a group of 10 and a group of 3. To the adult who already knows that $8+5=13$, this statement may appear to be obvious and trivial. It is not so simple to the child who is learning the basic fact for the first time. He can be helped to see and understand what happens by taking 2 objects from the 5 group and puttting them with the 8 group to make 10. The group of 10 and the group of 3 which remains may then be seen as 13 by use of the principles of the number system, as discussed earlier. These experiences in regrouping and the use of the principles of the number system help to provide for better understanding of arithmetic and for greater continuity and better sequence in the organization of learning experiences.

A similar situation occurs in subtraction. In learning the subtraction facts for the larger groups (such as $13-5=8$) through the use of objects or pictures, it is necessary first of all to know the number of objects in the original group (13). This should be accomplished by seeing, or regrouping, these objects as a group of 10 together with the "ones" (a group of 3). When the smaller (or subtrahend) group (5) is withdrawn, the group of 10 must be broken up, and a group of fewer than 10 remains.

In *Seeing Through Arithmetic 3* the addition and subtraction facts for the 11 group that are not taught by real action are taught on pages 66-70 by regrouping and imagined action techniques. There is, however, one other point to be noted here. When an addition fact is to be stated in either oral or written form, one of the numbers must come first. For example, suppose 5 girls are in one group and 6 more come to join them. Here the action in the situation helps us to decide which number comes first and which comes second. This situation would naturally be written as $5+6$ rather than as $6+5$.

When no action is suggested in the situation, but must instead be imagined, the answer to the question "Which number comes first?" is "Either one." For example, suppose 5 girls are in one group, and 6 are in another group. How many are in both groups? Here the written equation may be either $5+6=11$, or $6+5=11$. These written forms illustrate that the numbers in an addition situation may be added in any order. Although this generalization is important in later work, it is not necessary to emphasize it at this point in the pupils' learning. When a natural order for writing the numbers is not clear from the situation, the pupils may be told, informally, "You can choose which one to write first yourself." Later there will be a set of learning experiences designed specifically to focus attention on the generalization.

64-65 Moving forward

Lesson Briefs for this lesson are on poges 60-61.

Overview

Before the children can proceed to a study of the higher decade addition and subtraction basic facts (those facts with sums and minuends in excess of 10), they need some help in reorganizing the numbers 11 to 18 in terms of tens and ones.

On page 64, Movies A, B, and C show them how to approach such reorganization of the numbers. The first scene of each movie shows an unorganized arrangement of a group of objects (more than 10). The second scene identifies a group of ten, thus permitting rapid identification of the number as 1 ten and so many ones. Pictures D, E, and F show only the unorganized arrangement. The children must identify a group of ten and then discover the number of objects.

Page 65, Pictures G to O, continues the techniques begun on page 64. The block of practice at the bottom of the page gives the children an opportunity to express by written symbols the knowledge they have acquired.

Teaching the whole class

Page 64: Before beginning work with page 64, ask the children to look again at page 44. Let them talk

about the pictures. Review the idea that 14 means 1 ten 4 ones, that 18 means 1 ten 8 ones, and so on.

Then have the children turn to page 64. Ask:

Do you think that there are more than 10 jacks in the first scene of Movie A? We need to find a way to group these jacks so that it will be easier to find how many there are.

Ask the children to look at the second scene of Movie A. Get them to see that a ring has been drawn around 10 of the jacks. Ask how many jacks are outside the ring. Ask them to name the number that represents 1 ten and 5 ones. The children should know from their previous study of the number system that it is fifteen.

Tell the children to look again at the first scene of Movie A and to show different ways of finding a group of 10. Some may circle a group of 10 with their fingers. The children can also show a group of 10 by placing a small card or piece of paper on its edge between the group of 10 and the other objects. Check to see that they are doing the work correctly. Remember that not all children will see a group of 10 in the same way.

Movies B and C may be handled in the same way as Movie A.

Pictures D to F do not suggest any groupings of tens. Ask the children to show possible groupings with their fingers or with cards. Bring out the fact that they can find many different ways to make a group of 10. In each case, ask them to tell how many objects there are in all.

Page 65: If possible, give each child a piece of transparent paper to fasten to this page in his book. Tell the children to draw a ring around a group of 10 for each of the pictures G to O. Tell them to write the total number of objects in each picture at the right of the ring they draw.

Exercises A to L at the bottom of the page may be done orally first. For each exercise ask a child to give the answer and also to give the letters of the pictures on pages 64 and 65 that show this number. Then have everyone write the correct number for each exercise after its identifying letter.

Providing for the able pupil

Have pupils who finish the work on page 65 quickly, take other pieces of transparent paper and show different ways of ringing the tens in the quantities pictured.

Helping the slow learner

For additional practice in finding the ten and ones in various quantities from 11 to 18, children may work in pairs on an activity in which they put a ring around 10 objects. They will need 18 objects and a large sheet of paper divided into 8 sections. One child drops a handful of objects upon a section of the paper. The other child draws a ring around 10 of the objects to enable him to see quickly how many there are in all. See Activity 23, page 323, for full directions.

66-70 Moving forward

Lesson Briefs for this lesson are on pages 62-65.

Overview

Page 66 presents, by both real and imagined action, six of the addition basic facts for the 11 group. The situations show $6+5$, $4+7$, $9+2$, $2+9$, $3+8$, and $8+3$. The blue and the red dotted backgrounds used in Movies C and D are indications to the child that he can think of either group as being joined to the other. When either group can be thought of as joining the other, it is possible to teach an addition basic fact and its reverse in one movie. (For example, Movie C teaches $9+2$ and also $2+9$.) Note the use of the ring in the last scene of each movie to make it easy to identify the total as 11.

On page 67 the symbolism of the addition basic facts for the 11 group is introduced, and the remaining basic facts for this group are taught. The ring around 10 is used again to make recognition of the total easy.

Page 68 introduces the subtraction basic facts for the 11 group. Both real and imagined action are shown on this page. Where imagined action is shown, dimmed-off objects indicate the group that is thought of as gone. Here the ring around 10 is used again, this time to make it easy to identify the original group as 11. The situations shown on this page are: $11-2$, $11-5$, $11-4$, $11-9$, and $11-3$.

Symbolism for the subtraction basic facts appears on page 69, and the remaining facts for the 11 group are taught here.

Work on the 11 group is rounded out by two sets of exercises at the top of page 70. The first set deals only with the 11 group; the second consists of mixed practice on all groups taught thus far.

Teaching the whole class

Page 66: Start this lesson by reminding the children that on the past two pages they have been discovering how many there are in groups larger than 10 by first finding a group of 10 and then looking at the extra ones. Go on somewhat as follows:

Look at the first scene of Movie A on page 66. How many ducks are in the larger group? How many are in the smaller group? Why does the second scene make you think of adding? The third scene shows the ducks all together. How many ducks are in the

group inside the ring? How many ducks are outside the ring? A group of ten and one more is how many? 6 ducks plus 5 ducks equal how many? 6 plus 5 equals how many? Jerry, write this equation on the board.

Use the same procedure for Movie B. For Movie C say:

How many balls are in the larger group in the first scene? How many are in the smaller group? Look at the second scene. The balls cannot move together by themselves; so let's imagine the two groups of balls as one big group. The blue dotted background is to help us think of these two groups as one group. We can imagine that the groups have moved together. Look at the third scene. The ring is around how many balls? How many balls are outside the ring? A group of ten and one are how many?

We started with a group of 9 balls and a group of 2 balls. In the second scene we imagined the two groups together as one group. We can't tell by looking at this scene which group joined the other. Some of you may have thought of the 2 balls as joining the 9 balls. How many of you did? In that case 9 plus 2 equals how many? Look at the third scene for the answer. Who will write the equation for this on the board? Did anyone think of 9 balls joining 2 balls? What would the equation be then? Bob, write it on the board.

Treat Movie D in the same way.

Page 67: First let the children look at the page as a whole and identify the objects. Then direct attention to the first scene of Movie E. Ask questions like these:

How many airplanes are in the smaller group? How many are in the larger group? What is happening in this scene? Look at the second scene. What has happened? Can you tell, without counting, how many airplanes there are? What do you see in the picture that helped you find out? Who can make an equation that tells the story of what happened in Movie E?

Next ask the children to read the problem and equation at the right of Movie E. Tell them to use Movie E to check the facts given in the problem and to find the missing number. Then call on a pupil to read the problem and the equation aloud, saying the missing number.

Direct attention to the story beside Movie F. Have the children read it silently, without reading the equations. Ask them to find Tom's whistles in the first scene. Then have them point to Bill's whistles. In the second scene, ask what the blue background suggests. Tell the children to imagine that the two groups of whistles are one group. Tell them that the ring around some of the whistles will help them find out how many there are when the whistles are thought of as one group. Then ask:

How many of you imagined that the group of 5 whistles was put with the group of 6 whistles? Would the statement "6 whistles plus 5 whistles equal 11 whistles" tell this story? 6 plus 5 equals how many? How many of you thought of the group of 6 whistles as being put with the group of 5 whistles? Who can tell this story? Write it on the board without using the word whistles.

Next have the children read the two equations below the problem. Ask a pupil to read them aloud, saying the missing number.

Movie G and its text should be handled in the same way as Movie F and its text.

Page 68: Have the children look at this page as a whole and identify the toys pictured. Point out that Movies A and B go across the page, with three scenes in each. Beneath them are three more two-scene movies that run downward. Then focus attention on Movie A. Ask questions similar to these:

Do you think that there are more than 10 knights in the first scene of Movie A? What makes you think so? What does the second scene show? How many knights are there in all? The third scene shows a hand removing how many knights? What does this suggest? [*Subtracting*] *Let's see if you can figure out how many knights are left, without counting. 11 knights minus 2 knights equal how many knights? 11 minus 2 equals 9. Who will write this equation on the board?*

Movie B should be handled in the same way as Movie A.

For Movies C, D, and E, point out that the first scene shows the tens already grouped. The children can see immediately how many there are in each group because of the ringed group of 10. Explain to them that the dimmed-off portion of the second scene of each movie represents the group that should be imagined as taken away. Ask questions that will help the children determine how many should be imagined as taken away and how many will be in the group that is left.

Page 69: Before working with this page, give children a chance to describe any collections of model cowboys, policemen, firemen, pilots, etc., they may have. Then let them identify the toys pictured on page 69.

Ask questions similar to these:

Read Problem F. Then look at Movie F. How many cowboys are there in the first scene of Movie F?

How can you tell? Look at the second scene. Some of the cowboys are dimmed off. How many are dimmed off? To whom do they belong? Imagine that these 6 cowboys are leaving the group of 11 cowboys. Would that be subtracting or adding? Look at the group of cowboys that are not dimmed. They are the ones that would be left. To whom do they belong? How many are there? 11 cowboys minus 6 cowboys equal how many cowboys? 11 minus 6 equals 5. [*Have a child write the equation on the board.*]

Next have the children read the equation at the right ($11-6=\square$). Have them complete it with the information they found in Movie F.

The procedures used with Movie F may be adapted to Movies G, H, and I.

After finishing this page, the children have met all the basic facts for the 11 group. If any of the children seem to be having trouble remembering these facts, make up simple problems involving *real action*. Then let the children use objects and perform the combining and separating actions indicated by the problems.

Page 70: The two sets of exercises A to P may be handled orally first, then given as written work for all the children. The able children may be instructed, after they have finished the written assignment, to rewrite each equation in computational form.

Providing for the able pupil

If the addition and subtraction charts described in Activity 2 (see page 313) have been started, tell the children to include the facts for the 11 group.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 11 group. If equation cards are to be used, prepare them for the 11 group in advance.

70 Using arithmetic

Lesson Briefs for this lesson are on pages 65-66.

Teaching the whole class

Page 70: With this lesson, it might be well to set up a procedure for working with all future "Using arithmetic" problem sets that do not include helpful discussion material such as pictures or partial solutions.

Tell the children that, first of all, you want them to solve the problems without help. Instruct them to read each problem, think about the action taking place, and then make the equation, first with a screen (a square will do) and then with the answer. Or tell them that they can write the answer in the square that they made when they wrote the equation.

You will want to supply answers for the children so they can check their own work. To do this, you may write the answers on the board after the entire class has finished the problem set. Another way is to have the answers ready on a sheet of paper at your desk. The first pupil to finish should check his work. Then ask him to copy the answers on another sheet of paper and return the two copies to your desk. These can be used by other pupils as they finish their work. If necessary, additional sheets of answers can be prepared by other pupils as they finish.

When all the pupils have checked their work, find out which problems caused the most trouble and center class discussion on these. For the problems that only a few children missed, turn the class into a laboratory for group work and let the children who got the correct answers work with the others in explaining the solutions and in using objects to clarify understanding. Allow time for this kind of work, and move from group to group in helping the children.

If there is plenty of time and sufficient chalkboard space, still another method for checking answers and handling problem discussion is to ask various class members to put solutions for the problems on the board. Then ask each to discuss his solution and determine whether his answer is right or wrong. The remaining pupils at their seats can then check their own work against that placed on the board.

71 Side trip

Lesson Briefs for this lesson are on pages 66-67.

Teaching the whole class

Expanded Notes other than suggestions for the able pupils and slow learners are unnecessary for this lesson.

Providing for the able pupil

The able pupil is thoroughly at home with the calendar and should not need extra experiences. Some pupils, however, might enjoy making a calendar as suggested below for the slow learner.

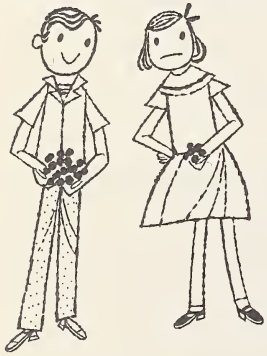
The able pupils might like to learn the familiar rhyme beginning, "Thirty days hath September, April, June, and November." Some of them might also enjoy learning the "knuckle way" of telling the long months of the year. For this, tell one child to close his hands, making two fists. Direct another child to name the months in the proper order as he touches first a knuckle, then a hollow between the knuckles of the other child's hands, starting with an outside knuckle. The knuckles represent the long months (31 days), and the hollows represent the short months (30 days and February). See the picture on page 248.

Encourage these children to bring to class calendars of other years and next year so that they can compare them with the current year.

Helping the slow learner

The slow learner might enjoy making a calendar for each month of the year. See Activity 24, page 324, for a description of how to do this.

Let children count on the calendar to find how many days there are until Christmas, until their next birthday, until the end of the school year, until the next school holiday, how many days there are between Thanksgiving Day and New Year's Day, etc.

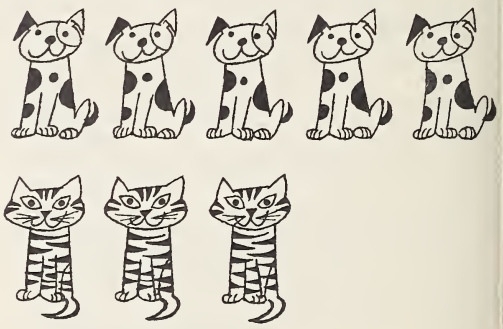


CHARTING THE COURSE

Comparative subtraction

One of the commonest uses of numbers occurs when one group is compared with another group. Suppose, for example, that Don has 5 puppies and Carol has 3 kittens. How many more puppies than kittens are there? The number of puppies is to be compared with the number of kittens. It has been customary to tell children to use the subtraction process in this case. If they can remember to subtract, they can obtain correct results. Very rarely, however, are they given any real help in understanding why subtraction gives the correct result.

The question is: What method of manipulating the objects not only solves the problem but also connects the process used with the child's previous experience with subtraction? A comparison situation is not a subtractive situation of the kind studied earlier. In previous subtractive situations a single group was given. A subgroup was taken away, and the remainder was then found. In the example above, the group of 3 kittens is not a subgroup of 5 puppies, and there is nothing in the situation to suggest the subtraction process. Something must be done to show the child why he can use the process of subtraction in this situation. What is done must make clear that he does not subtract 3 kittens from 5 puppies. Moreover, the logical and psychological issues involved here cannot be evaded by thinking that both kittens and puppies are animals, and hence saying "Subtract 3 animals from 5 animals."



In the basic comparison situation there are two groups, each of known size. The fundamental concept involved is the one-to-one correspondence of the objects in the two groups. When the members of one set of objects may be matched or paired one to one with the members of the other set, we say the two groups are equal.

Whenever a comparison is to be made, we can start to set up the one-to-one correspondence and continue until all the objects in one group have been used. If some unmatched objects remain in the other group, we may observe this excess and say, for example, "There are more puppies than kittens." At the same time, we may observe that there are not enough in one group to match all of the objects in the other. If we give attention to this shortage, we say, for example, "There are fewer kittens than puppies." Both statements describe the same situation, but from different points of view. In the first case the group of kittens is used as a kind of basic group

or standard. In the other case, the group of puppies is used as the basic group.

It is often desirable to make more precise comparison statements. The question may be: "How many more puppies are there than kittens?" In this case the group of kittens is taken as the basic group. If we think of a group of puppies that are matched one to one with the kittens, the number of puppies in this group tells how many matching pairs can be made. To demonstrate how the numerical answer may be found, the actual objects that are matched may be covered or imagined as taken away. The number of objects that remain is the "answer." Thus, in the illustration on page 248, if we imagine that the group of 3 puppies that matches the 3 kittens is gone, we can think "5 puppies (or Don's original group) minus 3 puppies (that are matched with Carol's kittens) equal 2 puppies." This answer would usually be stated: "There are 2 more puppies than kittens."

Similarly, suppose attention is focused on the smaller group—the kittens—and the group of puppies is used as the standard. There are 2 fewer kittens than puppies. The numerical part of the answer is the same; but when the primary interest is in the shortage, we describe the answer by using the word "fewer."

In the demonstration described above, the covering of the subgroup of matched objects suggests the process of subtraction. When the groups and the action are symbolized (for example, as 5—3), the process of subtraction is used to find the answer. In traditional teaching, any explanation along the lines just explained is avoided. Instead, pupils are merely told that in situations like this the smaller number is to be subtracted from the larger. Teachers who try to employ dramatization and similar visual techniques to develop an understanding of this situation should direct the children's thinking along the lines described above.

The analysis of comparative subtraction given above is the basis for the treatment on pages 72 to 74. In introducing this new type of problem situation, only examples involving subtraction basic facts that the children have already learned are used.

72-74 Exploring problems

Lesson Briefs for this lesson ore on poges 67-69.

Teaching the whole class

Page 72: To introduce pupils to the idea of comparative subtraction situations, it might be well to try the following activity before opening the books. Place 5 small blocks in a central place where all can see. Bring out a paper bag or box and tell the children there are 11 corks in it. Then ask the class if they can think of a way to find out how many more corks there are than blocks. Give them time to think through what they would do with the objects. If necessary, ask questions to bring out the idea of matching members of the smaller group with members of the larger group. When a pupil suggests matching the two groups of objects and then counting the number of corks left unmatched, let him do this. Tell him to take only one cork at a time out of the bag or box to match with the blocks. Explain that the number of corks left in the bag or box will show how many more corks there are than blocks. Let him find out how many more there are.

Tell the children that there is an arithmetic way to find how many more there are in one group than in another and have them open their books to page 72. Tell them to read the problem opposite Picture A. Tell them they are first going to find out how many more cups there are than plates. Have them look at Picture A. Ask how many plates are stacked up. Ask them if they can tell how many cups are in the box. Let them tell how they can find out how many cups there are. Next tell them to read the material opposite Picture B. Have someone read it aloud. Ask the children what has happened in Picture B. If necessary, recall what was done with the corks and blocks. Have them read next the first sentence opposite Picture C. Ask why the 5 cups in Picture C have been dimmed off. Then have a child read the equation "11 − 5 = how many?" aloud. Ask the children what the numerals and signs stand for in this equation. Tell the children to read the material at the right of the equation, giving attention to where the arrows point.

Next call the pupils' attention to the work labeled "Compute." Recall the computational form, and, if necessary, have them refer back to page 11. Explain that the word *compute* (write it on the board) tells them to write numbers in computational form and to find the answer. Have them read silently the rest of the material on the page. Then call on a pupil to read it aloud. Point out that when the answer [6] was obtained, the equation was rewritten and the answer put in place of the screen that had been used before. Point out the equation in this first form opposite Picture C.

Now have the children look back at the two questions asked in the problem opposite Picture A. Have them read aloud the sentences at the bottom of the page that answer these questions.

Page 73: Adapt the procedures suggested for page 72 to this page. Note, however, that the answer is not given. The children must find it themselves.

Page 74: Work through Problem A with the children orally. Be sure they understand what each number and sign in the equation stands for. Then ask them to write the answers to Problems B to I on their papers. Tell them in each case to write the equation with the screen (or a square) first, then to write the numbers in computational form and compute to find the answer. When they have found the answer, they can rewrite the equation with the missing number in it or they can write the answer in the square or over the screen. Note that Problems E and I are not "how-many-more" situations. If some of the children have trouble with any of these problems, help them write the equations on the board. Using arrows, add explanatory phrases similar to those given in the book for Problem A. Use objects, if necessary.

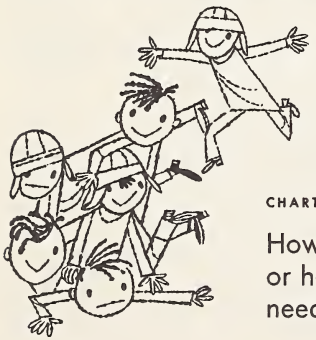
Have the children work through the "Keeping skillful" exercises that review some of the basic facts and the regrouping of tens and ones. Use this as written work, and have the children write the answers only.

Providing for the able pupil

Put pairs of numbers on the board and let the children take turns making up problems about how-many-more and how-many-fewer, using the numbers.

Helping the slow learner

Use the same activity described above, but instead of using pairs of numbers, use two groups of objects (5 pieces of chalk, 3 erasers; 10 corks, 6 jacks; etc.).



CHARTING THE COURSE

How many added or how many more needed?

In an important type of problem situation, the question to be answered is, "How many were added?" For example, John had 17 books. Then a friend gave him a bundle of old books. Later, when John counted all his books, he found he had 32. How many had his friend given him?

In other problems of this same type, the question is, "How many more are needed?" For example, 32 parents are coming to visit school. There are chairs for 17. How many more chairs are needed? An analysis of situations of this type shows, first, that there is always a group of known size to begin with. Second, the known group has been (or is to be) increased by combining with it a group of unknown size. The size of the *combined* groups is also known.

It should be observed that the question "How many more are needed?" arises from a special kind of social situation. This question does not adequately describe the general situation. In some situations the unknown amount that is added may not be "needed"—it may actually be unwanted. For example, "Yesterday 5 pupils were absent because they were sick. These same pupils and some more are absent today for the same reason. How many have been added to the 'sick list'?"

This more general type of problem situation has been unrecognized in the professional literature on arithmetic and neglected in arithmetic materials for children. The emphasis has been on a special social application of the type. Moreover, the type is commonly considered only in connection with discussions of subtraction. It cannot be emphasized too strongly that the action involved in solving this kind of problem is of the combining, or additive, type. Difficulty arises, however, because the number to be added is unknown. The problem situation, when represented by symbols, cannot be solved directly by addition, as is the case when two groups of known size are combined and the number in the total group is wanted. When the numbers in the situation are small, the answer comes to the mind of most adults so easily that the basic difficulty in the general situation may not be fully recognized.

In teaching children how to solve a problem of the type under discussion, it has been customary to tell them "Subtract the smaller number from the larger." Through constant drill upon problems of the same general type, some children learn to solve them. This is true in spite of the fact that the action called for is clearly combining, or additive, but the process used is subtraction. In the past, few children have been helped to understand why subtraction is used to solve an additive problem.

The key to understanding this type of problem is the recognition that by additive action the unknown additional quantity is brought in. When the problem is solved

with objects, the number of additional objects can be determined by a process of "counting on" one by one until the total number is at hand. Thus, in the problem about John's books stated above, one could say "eighteen, nineteen, twenty," and so on up to thirty-two. The number added could then be found by a new count of the objects added, this time starting with one and ending with *fifteen.*

The objective of the lesson in *Seeing Through Arithmetic 3* is to enable the child to solve such problems with symbols and without counting. First the child must learn to visualize the total quantity. He must then imagine that the group at hand originally has been removed and that only the group that was added remains. Only then will he understand the reason for subtraction with the symbols. It should hardly be necessary to point out that he will need experiences using real objects before he can visualize the situation in this way. The lesson on pages 75-78 includes a pictorial treatment of the kind of experiences necessary.

75-78 Exploring problems

Lesson Briefs for this lesson are on pages 70-72.

Teaching the whole class

Page 75: Have the children open their books to page 75 and read Problem A and the text opposite Picture A silently. Tell the children to look at Picture A, where the 6 leaves June had at first are shown. Explain that the large blue 6 stands for the leaves June had at first and is the first part of an equation that will describe what they read in the problem and will see in the pictures. Go on somewhat like this:

Now read the sentence opposite Picture B and look at Picture B. Does this picture show how many leaves Carol gave June? Does it show only that a group of leaves was brought in to join the first group of leaves? What process does this make you think of? What sign should be written after the 6 to show adding? Since we don't know how many leaves were brought in or added, we have to put a screen after the plus sign.

Now look at Picture C. How many leaves are shown? Now look at the equation. What has been written after the screen? Does this equation mean that 6 plus some unknown number equals 11?

Now we must use the numbers in the equation and compute to find the answer. Let's see if we can find out what we must do to get the missing number. Look at the sentence opposite Picture D. What does Picture D show? What does the large blue 11 stand for?

Page 76: Ask questions similar to these:

What does the sentence opposite Picture E tell you to do? The ring around some of the leaves in Picture E shows the number of leaves June had at first. The large 6 also stands for the number of leaves she had at first.

Read the sentence opposite Picture F. How does Picture F show that you should imagine this group of leaves as gone? The number left will show the number of leaves Carol gave her. Why does this make you think of subtracting?

Look at the work in computational form opposite Picture F. The 11 stands for the leaves June has altogether. The 6 beneath the 11 stands for the leaves June had at first and which you are now imagining as gone. This means you should subtract. Look at the work under Picture F. What is the answer?

Look back at the equation opposite Picture C on page 75. If you put the number 5 in place of the screen, is the complete equation correct? Carol must have given June 5 leaves.

The new problem opposite Picture A gives the children a chance to apply what they have just learned. This time the problem is of the how-many-more-are-needed type. Use questions similar to those just outlined to guide the children in their work with this problem. Note that the material to read contains more questions, to guide thinking instead of giving information.

Page 77: Before the children begin to work the problems on this page, it might be well to dramatize a few problem situations of the subtraction type being taught in this lesson. For example, let one child take several objects and tell the class how many he has. Then give him some more of the same kind of objects. (The quantity should be known to you but not to the children.) Ask him how many objects he now has and tell him that he is to find how many objects you gave him. Suggest that he lay all his objects in a group on a table and see how many in all he now has. If he needs further help in solving the problem, guide him to see that he first should remove a group of objects equal in number to those he had at first. Then the group that is left will be the number you gave him. Next help him to make a record of what he has done, first by writing an equation on the board to show the problem situation. Then these numbers may be written in the computational form that is suggested by the actions he had to perform to solve his problem with real objects.

For the problems on pages 77 and 78, work through the first two with the class. Give special attention to the diagrammatic explanations for Problems A and B. Then ask the children to write the letters A to T in a column on their papers (Problems M to T are on page 78). Tell them to read each problem silently and then write the equation. Next they are to write the statement "Subtract 5 from 9" (or whatever numerals are involved). Finally they are to rewrite the equation with the answer inserted (or they can write the answer in the square in the original equation). Problems L, O, and Q involve different kinds of equations for solution. Some previously taught problem types are always included so that children will not fall into the habit of blindly making the same equation without thinking.

Page 78: When the children have completed the problems, go over all of them in class so that the children may check and correct their work.

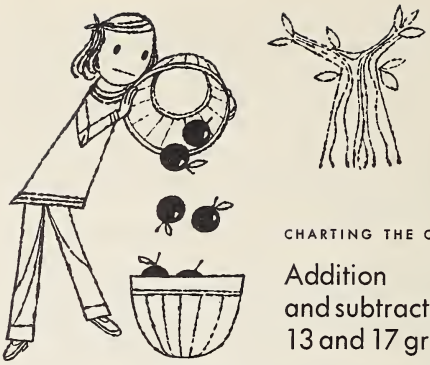
The "Keeping skillful" exercises at the bottom of the page review basic facts in equations of two forms. Have the children do the first block of exercises (A to X) orally first. Ask them to look at each equation and tell what they would do to solve it. (For Exercises A to L, of course, they must subtract.) For equations of this type, the children should by this time be able to visualize the resulting computational form and give the answer immediately, since a subtraction basic fact is involved. Exercises M to X involve addition basic facts only. Exercises in the second block (A to X) involve all types of equations taught so far. Have all the children copy the letters A to X in two columns and write each answer after its letter.

Providing for the able pupil

Write pairs of numbers on the board and let the children take turns making up problems about how-many-were-added and how-many-more-are-needed, using the numbers. The child should also give the equation and answer for his problem.

Helping the slow learner

Children experiencing difficulty with this type of problem should be given opportunities to dramatize situations of the additive-subtraction type. Small toys, such as toy autos, airplanes, blocks, etc., should be given them to work with. The children can work in pairs, a slower child teamed with one of the abler pupils. The slow learner can select a quantity of whatever object is being used. His partner can then give him some more, without letting him know how many. Then the first child has to use the whole group of objects to perform the actions necessary to find how many were added. The partner can check his work and thinking.



CHARTING THE COURSE

Addition and subtraction 13 and 17 groups

In *Seeing Through Arithmetic 3* the same general method is used to teach the basic facts for all groups larger than 10. This method was used first with the 11 group on pages 64-70. It is used again in presenting the basic facts for the 13 and 17 groups on pages 79-82.

The addition and subtraction basic facts for the 13 and 17 groups have long been considered to be among the "difficult" ones. When children tried to learn these facts by rote methods, they made many errors. Teachers should observe that the methods used in *Seeing Through Arithmetic 3* differ markedly from rote methods. A very general principle is followed. It involves the rearrangement of objects into groupings that correspond to the standard groupings of the number system. This emphasis upon concrete situations and general principles is consistent with modern theories of learning. These methods lead to understanding and remembering, in contrast to mere memorizing and forgetting.

Although the program of *Seeing Through Arithmetic 3* develops understandings, a fact once learned may be forgotten if it is not used very often. The materials on pages 83-85 provide one of the recurrent opportunities for "Keeping skillful," "Checking up," and "Using arithmetic" found in the *Seeing Through Arithmetic* program.

79-82 Moving forward

Lesson Briefs for this lesson are on pages 72-74.

Overview

On page 79, four of the six addition basic facts for the 13 group are taught by use of pictures and text. Movies A and B show real action for the situations $4+9$ and $9+4$. In Movie C the dotted background is used to help the child think of groups of 8 and 5 as combined. Since either group can be thought of

as joining the other, it is possible to teach 8+5 and 5+8 in the same movie. In all three movies a ring is used in the second scene to identify a group of 10 and thus make it easy to name the total quickly.

The first movie on page 80 completes the teaching of the addition basic facts for 13. The second movie teaches the two addition basic facts for the 17 group. The techniques of imagined action and a ring to identify 10 are used again here. Movies F and G employ real action to illustrate two of the six subtraction basic facts for the 13 group. Note how the ring is used in the first scene to identify a group of 10.

The remaining four subtraction basic facts for the 13 group are developed on page 81. Again the ring is used to identify the group of 10 to make it easy to recognize the size of the original group. The dimmed-off objects indicate the imagined action of the problem and point out the group from which attention is to be diverted.

The two subtraction basic facts for 17 are taught on page 82. Techniques described above are used again here. The practice at the bottom of the page reviews the facts taught for 13 and 17 and also reviews other basic facts, in various forms, taught up to this point.

Teaching the whole class

Page 79: Introduce this new block of work by asking the children if any of them have ever been at the seashore. Let them describe their experiences. If any of them found sea shells, let them describe them. Ask the children to bring any shells that they have collected and show them to the class. Then have them look at the pictures and problems on page 79.

Procedures suggested for teaching the addition basic facts for the 11 group (see Expanded Notes for page 67, page 246 of this Teaching Guide) may be adapted for page 79.

Page 80: Teaching procedures used with page 79 may be used with the addition basic facts presented on this page. For minor adaptations needed for teaching the subtraction basic facts, see the Lesson Briefs for page 80, found on page 73.

Page 81: Procedures suggested for teaching the subtraction basic facts for the 11 group (see Expanded Notes for page 69, page 246 of this Teaching Guide) may be adapted for this lesson. See also the Lesson Briefs for this page, which are on page 74.

Page 82: Adapt procedures suggested for the preceding page in handling the subtraction basic facts introduced on this page.

The exercises reviewing the basic facts should be done as written work. Ask pupils to write the complete equation in each case.

Providing for the able pupil

If the addition and subtraction charts described in Activity 2 (see page 313) have been started, tell the children to include now the facts for the 13 and 17 groups. Tell them to leave a row blank on their charts for the 12 group, which they will study a little later.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 13 and 17 groups. If equation cards are to be used, prepare them for the 13 and 17 groups in advance.

Remind children also to make practice cards for the basic facts that cause trouble. See Activity 8, page 317.

83 Keeping skillful; Checking up

Lesson Briefs for these lessons are on page 75.

Expanded Notes are not considered necessary for these lessons.

84-85 Using arithmetic

Lesson Briefs for this lesson are on pages 76-77.

Teaching the whole class

Page 84: The four pictures at the top of this page test children's ability to recognize a problem situation by means of the action involved and to solve it. Call on different pupils to tell what is happening in each picture and to tell whether the action that takes place makes them think of adding, subtracting, multiplying, or dividing.

Call attention to the screens and wavy lines included with the pictures and ask the children to retell what is happening in each picture by making an equation that fits and replaces these screens and wavy lines. You might ask a child to write each equation with its answer on the board, too.

For the problem set that begins on this page, have the children read each problem silently and try to "see" what is happening. Some of them may need to use objects to help them visualize what is happening. Tell the children that after they are sure they understand what the problem is about, they are to write the equation that tells the story, then give the answer to the problem. This problem set is continued on the next page.

Page 85: After the children complete the problem set, go over the problems orally with them. Let them take turns saying the equations and the answers. Take time to discuss thoroughly any problems that have caused an unusual amount of difficulty.

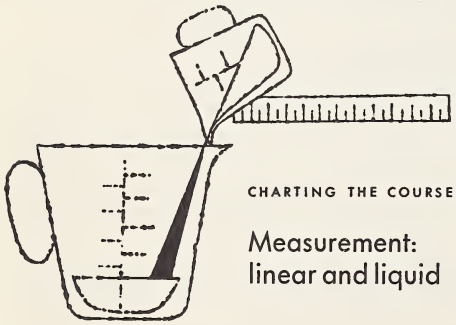
The "Thinking straight" exercises should be done orally. The purpose of these problems is to help the children learn that for some problems there is no one "right" answer. This is true for Problems B and D. June would get more candy if she bought the suckers illustrated in Picture A, but she might want to share with two friends. In that case she would want to buy the three suckers for the same amount of money. For the problem about the peaches, help the pupils see that the 25 peaches might spoil before Ellen could use them. Ellen might buy either 1 peach or 5 peaches. Her action would depend upon whether she wanted as many as 5 peaches.

Providing for the able pupil

Activity 14 on page 320 may be used with this lesson. Try to have the children make problems for all the types of situations studied so far.

Helping the slow learner

Activity 14, suggested for the able pupil, may also be used for the slow learner. However, allow these children to use objects to solve the equations. Remind them not to use more than eleven objects in all.



CHARTING THE COURSE

Measurement: linear and liquid

Children meet many measurement situations in their play and in their school work. They need to learn early that measurement requires, first, choosing a unit and, second, finding how many times the unit is contained in whatever is being measured.

In the introductory stages of instruction on measurement, the use of standard units, such as the inch or foot, is unnecessary. The children can become acquainted with the *idea* of a unit by using any convenient object (stick, pencil, strip of paper, etc.) to measure lengths. Similarly, the idea of a unit of capacity may be introduced by using a bottle to measure a quantity of water. Children learn to use phrases such as "more than" or "a little less than" to describe situations in which lengths or quantities cannot be measured exactly by the unit used.

When these basic ideas of measurement are understood, children may be made aware of the need for standard units and become familiar with them. The inch, foot, pint, and quart should be familiar to most children in Grade 3, either as a result of informal experiences in school or at home, or of more systematic instruction on measurement. In the *Seeing Through Arithmetic* program these units are introduced in Grade 2. These standard units are retaught in *Seeing Through Arithmetic 3*. The yard as a standard unit of length and the gallon as a standard unit of capacity are introduced in *Seeing Through Arithmetic 3*. Some children may also be familiar with these units from informal experiences. In fact, many children may know the word *mile*, but systematic instruction on the mile and units of length or of capacity other than those mentioned above may be deferred to later grades.

Children should learn that 12 inches are the same length as 1 foot, that 2 pints equal 1 quart, that 3 feet equal 1 yard, that 36 inches equal 1 yard, that 4 quarts equal 1 gallon, and that 8 pints equal 1 gallon. These facts should be brought out naturally as these units are introduced. There is no need at this level for systematic drill on the "tables of measures."

86-91 Moving forward

Lesson Briefs for this lesson are on pages 77-80.

Overview

The work on these pages is designed to give the child a working knowledge of simple linear and liquid measurement. The lesson is a long one and should be spread over as many days as are necessary for a thorough understanding of the material. The lesson begins with the inch on page 86 and continues on page 87 with the foot and yard. Exercises testing the child's ability to select the appropriate measuring unit from these three and to place the measuring instrument correctly when measuring are found on page 88. Page 89 introduces three units of capacity—the pint, the quart, and the gallon; page 90 shows the relationship of each of these measures to the others. The final page of the treatment offers exercises and problems involving these measuring units.

Teaching the whole class

This lesson will be much more meaningful if you arrange in advance to have the children bring an assortment of materials to school—rulers, yardsticks, tape measures, and a variety of containers, such as milk bottles, mason jars, measuring cups, paper cups, ice-

cream cartons, etc. (Empty gallon containers of one kind or another can probably be found within the school building.) It is a good idea to have a supply of some kind of dry material that may be easily poured from one container to another (for example, navy beans), or a pitcher of water and a small funnel. It will be helpful to have on hand enough pieces of cardboard, exactly 1 inch square, so that each child may have one or more of them. Also provide a number of unmarked sticks of varying lengths. (These may be cut from oaktag.) It will be useful as well to have a number of rulers marked only in whole inches, rather than inches and fractions of inches; if these are not readily available, strips of cardboard so marked may be substituted.

Before the children open their books, there should be a general discussion of the meaning of measurement, how it is used, and why we need to agree on a unit of measure. The children should understand that measurement requires not only choosing a unit to measure with, but also finding out how many times this unit is contained in whatever is being measured. At this stage, and throughout the lesson itself, the entire class should participate in demonstrating measuring activities. Children may be given unmarked sticks of any length and allowed to measure their desks, each other's heights, and other lengths in "stick lengths." They will enjoy guessing how many paper cupfuls of beans a given container, such as an empty tin can, will hold, and then trying out their guesses by filling the container. You may prefer to use water; if ordinary precautions are taken and paper towels are on hand to use, water will provide additional interest. The same container may be refilled, this time using a larger measure of capacity, such as a glass.

These preliminary experiences with measurement need not involve any standard measuring unit, since what we want to bring out here is the fact that anything may be used as a measuring unit; that to find out the size, quantity, or amount of something, we need to know how many times any given measuring unit is contained in it; and that to understand the description of a measurement made by another person, we need to know from our own experience exactly what kind of measuring unit was used in getting the measurement.

The importance of understanding the measuring unit used in any given measurement can be brought home to the group by reading a recipe for making fudge and discussing what might happen if one did not know what kind of cups were to be used in measuring the milk and sugar called for in the recipe, or what might happen if very large cups were used to measure the milk and very small cups were used to measure the sugar.

Another method of showing the need for standard units is to have the same distance measured with unmarked sticks of differing lengths. For example, two identical chalk lines on the floor, one at each end of the room, could be prepared ahead of time. (The reason for separating the two lines by a roomful of desks is to avoid a visual comparison of the lengths.) Then, after some discussion to bring out the fact that measurement is a way of finding out the size or amount of something, you might give one child an unmarked stick and another child a somewhat longer unmarked stick. (The chalk lines and sticks may be of any desired length. In the discussion that follows the lengths that have been imagined in use are: chalk lines 70″ long, short stick 14″ long, long stick 17½″ long.) Sticks may be cut from oaktag or dowel rods.

Let the first child measure one of the chalk lines and report on his findings, and then let the other child do likewise with the remaining chalk line. If you have used the suggested lengths for this activity, one child will probably say that the line he measured was 5 sticks long, while the other child will say that the line he measured was only 4 sticks long. Let all the children decide whether or not one line is longer or shorter than the other, and instead of commenting on their answers, have the two children exchange sticks and measure their chalk lines again. This time the supposed "long" line will have become the supposed "short" line. Let the class discover why this happened by comparing the sticks, and then have a third child use the same stick to measure both distances. If he uses the 14″ stick to do this, he can say "Both lines are 5 sticks long," or, more accurately, "5 of *my* sticks long." If another child is then given the 17½″ stick and allowed to perform the same measurements, he will be able to say with equal truth, "Both lines are 4 of *my* sticks long."

You might now ask questions such as these:

Suppose we wanted to buy a table that would be as long as the line we measured on the floor. How could we tell a clerk in the store what size we wanted our table to be? Would he know what we meant if we said we wanted one that was 5 of John's sticks long or 4 of Bill's sticks long? Wouldn't it be a great nuisance to have to take our sticks along with us to show the clerk so that he would know what we were talking about? Can you think of any other kinds of measuring sticks which many of you have in your homes, sticks that have a name that means the same length anywhere in the United States?

A number of children may think of the yardstick. Instead of prolonging the discussion of the yardstick, this might be a good moment to lead the children into the material in the book by such statements as:

The yardstick is one of the longest measurement instruments we will study. But now let us begin with one of the smallest measures—the inch. Let's find out how long an inch is.

Then have the children open their books to page 86.

Page 86: Because children are accustomed to seeing pictures of objects greatly reduced from their actual sizes, explain to the class that all the pictures on this page are true sizes. Let them compare their own index fingers with the finger in Picture A and their own index fingers with an inch on a ruler. Also let each child discover which of his finger joints most nearly equals one inch. Show him how he can measure with it.

If you have followed the suggestion of having one-inch squares of cardboard on hand, now might be a good time to distribute them to the children, one to a child. Each child may then compare his cardboard inch with those pictured in A, B, C, D, and E and be ready to answer questions about whether the penpoint, the nail, the whistle, and the paper clip are longer than, shorter than, or just the same length as an inch.

Pictures F to J may be handled in the same way. Let the children observe here that when inch-long pieces are put together to make a greater length, they must fit closely together and not overlap. Foot rulers marked only in inches, or strips of cardboard similarly marked will be found helpful here, since pupils can compare their cardboard inches with those marked on the ruler and discover that there are 12 of these inches on it. They will then be ready to learn that whenever we have a length of 12 inches we call it 1 foot.

Page 87: On this page and on the following pages of the lesson the objects are shown considerably reduced from actual size. Children should have no difficulty in observing this, since the hand holding the foot ruler in Picture A is drawn to the same scale as the ruler and objects. The smallness of this scale will be clarified for the pupils if they are asked to compare this hand with the finger on page 86. They may also compare the small pictured foot ruler with a real foot ruler. Let them imagine the reduced foot as divided into 12 equal parts, each one equal to the inch shown full size on the facing page. Explain that just as inches may be put together to make a larger unit called a foot, so feet may be put together to make a larger unit called a yard, and that it takes 3 feet to equal one yard. Let the children check this by laying real or cardboard foot rulers on a yardstick.

Next let the class discuss how long the objects in the pictures appear to be. In this discussion bring out the fact that some objects are being measured with foot rulers and others with a yardstick, and help the children discover why one kind of measuring unit may be better to use than another in a particular situation. In several pictures children may find more than one way to describe the size of the object. Picture D, for example, may be said to be "a little more than 2 feet" or "a little less than 1 yard."

Page 88: You may find it helpful to begin the work on this page with a general discussion of right and wrong ways of measuring—whether or not it makes any difference where the measuring instrument is placed against the object to be measured, for example. Then let pupils take turns picking out the right and wrong way of measuring shown in each pair of pictured objects in the top section of the page. Help them to see the mistake that was made in each case and to explain why it was wrong. The children should also be able to explain why some of the objects have been measured with yardsticks and others with foot rulers. (The window in Picture I and the map in Picture J may be measured with either foot rulers or a yardstick.) Let the children discover which unit is easier to manage on a long length by measuring a real window or map with both rulers and a yardstick. When they are using the foot rulers, you may need to remind them not to make the same errors of placement that are shown in Picture J.

Then direct attention to the small pictures in the lower left-hand corner of page 88 and let pupils take turns in answering Question A, explaining why they chose the unit they suggest. For Question B, you might write some of the estimates on the chalkboard and then let the children discover whose estimate came the nearest to the actual length. In measuring the real object, they may use whatever measuring unit

they think best. Children may work in groups on the measuring activities for the larger objects, if you wish.

Page 89: One way to introduce the work on this page is to ask questions such as:

Have you ever been shopping with Mother and heard her ask for a pint or a quart of something? What are some of the things that are sold in pints or quarts?

Let the class compare the differences in appearance between a pint milk bottle and a pint ice-cream carton. Show the class that somewhere on each container is a statement saying that it holds one pint. The equality of these two containers may be demonstrated by letting a child fill the carton with beans or water and pour this material from the carton into the bottle. From the assortment you gathered earlier, other children may choose containers that they think will hold about a pint. Allow each child to test the container of his choice by filling it with material poured from the pint bottle. The same type of activity may be used in working with quart and gallon measures. Activities of this kind may need to be prolonged until all the children understand that differently shaped containers may hold equal amounts.

Next let the children look at Pictures A to C in the book, which show illustrations of pint, quart, and gallon containers. Then let them identify the containers in Pictures D to O by comparison with those in Pictures A to C. For each container D to O, let the child tell whether or not he is sure of the size as pint, quart, or gallon and why.

Page 90: Have the children look at Movie A and identify the two containers used for measuring. Let them discover that it takes liquid from two pint containers to fill the quart pitcher, and help them state this as "2 pints equal 1 quart." Have volunteers come up to demonstrate this fact, using real containers. The same fact viewed a little differently (1 quart equals 2 pints) may be shown by having the filled quart container emptied into the two pint measures.

Movies B and C may be treated in the same way.

Page 91: Direct attention to the first block of exercises (A to L). Have the children write the letters A to L in a column on their papers. Explain that when they see a screen (▤) in an exercise, they are to supply the right *number;* when they see a wavy line (⁓), they are to supply the right *word.*

For the rest of the work on the page (A to O), have them write the letters A to O in a column. Tell them to read each problem, and after its letter write the equation with the answer if they are to add or subtract, and to write just the word or number if the problem does not involve adding or subtracting.

Providing for the able pupil

A group of children may be put in charge of measuring the height of the children in the class in feet and inches to the nearest inch. See Activity 25, page 324, for complete details.

These children may also measure the width of the hall, their desks, etc. Let each child do his own measuring. Then give them an opportunity to compare their measurements.

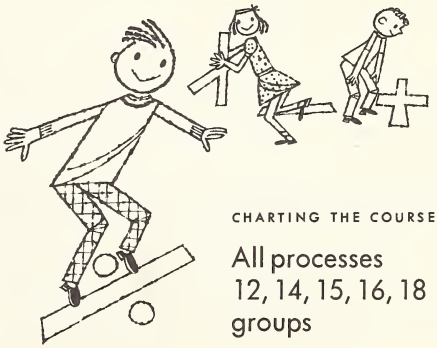
Helping the slow learner

Have in the room several kinds of small objects similar to those shown on page 86. You might have several of each kind. Let each child measure one object with a ruler. Then let them trade objects to give them the experience of seeing that they will all get the same length if they measure the objects correctly.

A number of measuring experiences may be provided through a game of Ring Toss. See Activity 26, page 324.

If some of the children do not have rulers of their own, help them make a simple one of cardboard (showing inches only). See Activity 27, page 325.

As another activity, have the children use their rulers in doing art work. See suggestions in Activity 28, page 325. Restrict the work to designs, omitting rectangles and triangles.



CHARTING THE COURSE

All processes
12, 14, 15, 16, 18
groups

All the basic facts for groups of 12, 14, 15, 16, and 18 are introduced on pages 94-123. The methods of teaching these facts are essentially the same as those used earlier in *Seeing Through Arithmetic 3;* so no further discussion of method is needed here. It should be noted, however, that when this block of material has been completed, all of the addition and subtraction basic facts have been introduced.

Pages 92-93 of *Seeing Through Arithmetic 3* are designed to help pupils gain insight into a special divisive situation. When a problem involves quotitive division,

the result tells the number of equal groups in the dividend. In "concrete" or social situations that lead to quotitive division, there is a step in the thinking process that is often overlooked. As a sample problem, consider the following: "If apples cost 2¢ each, how many apples can Jack buy with 10 pennies?" In this problem, two sets of objects are involved—apples and pennies. The fact that the apples cost 2¢ each establishes a one-to-one correspondence between one apple and a group of 2 pennies. Then the problem is to find how many groups of 2 pennies can be made out of 10 pennies. In a realistic demonstration of the solution of this problem, the 10 pennies would be arranged in groups of 2, and an apple would be placed beside each group. In other words, the number of apples that can be bought is the same as the number of groups of 2 pennies.

In problems of the above type, the numbers to be processed are associated with one kind of object, but the answer to the problem is expressed in terms of a different kind of object. The shift from one kind to the other is accomplished by a one-to-one correspondence, but this is usually overlooked. In the traditional program pupils have learned to solve this problem situation more by repeated experience with it than by understanding the nature of the situation.

92-93 Exploring problems

Lesson Briefs for this lesson are on pages 81-82.

Teaching the whole class

Page 92: Have the children read the problem and relate it to the first scene of Movie A. Let the class discover why the pennies are in groups of 2 in the next scene. You might suggest that there is another way of finding how many groups of 2 pennies there are besides counting the pairs in the picture (by computing). If necessary, you could encourage this discovery by discussing the final scene and the accompanying text. Children may also act out the buying of the candy sticks by using objects and play money. When the action underlying the equation has been thoroughly discussed and understood, let someone read the equation aloud. Then let another pupil explain what each number in the equation stands for. It will be helpful to have the equation written on the board for this explanation.

Problem B may be taught in the same way. Note that the step of grouping without matching has been eliminated in the movie for this problem.

Page 93: Before assigning these problems, discuss the first two thoroughly with the class. Then let the children complete the remaining problems with a minimum of assistance from you. They are to label their problems C to I, according to the letters in the book. After each letter the proper equation should be written with a screen or square. The equation may then be rewritten with the answer, or the answer may be written in the square or over the screen.

The "Keeping skillful" exercises should be treated as a separate activity. Exercises A to L may be used as oral or written work. For the second block of exercises (A to F), children are to think the computation and then write the equation with the answer in place of the screen. Only the answers need to be written for the exercises (A to F) in the last block. Children should label all written work as it is in the book.

Slower pupils may still need the assistance of objects in getting answers to problems and exercises on this page.

Providing for the able pupil

Have able students take turns making equations in division and inventing problems of the type studied in this lesson to fit the equations. See Activity 14, page 320.

Helping the slow learner

The problems invented by the able pupils in connection with Activity 14 may be used for this group. Let them use two sets of objects (toy money and sticks for candy, for example), if necessary, to help them solve the problems. The able learners might supervise the work of the slower learners.

94-102 Moving forward

Lesson Briefs for this lesson are on pages 82-87.

Overview

Pages 94-95 present the seven addition basic facts for the 12 group. Teaching is begun with real action on page 94 and is continued with imagined action on page 95. A dotted background indicates the combining action for those pictures showing imagined action, and a ring is used throughout to isolate a group of 10 and make it easy to identify the total of 12.

The subtraction basic facts for the 12 group are taught on pages 96-97. Real action is used to introduce three of these facts. In the remainder of the pictures, objects are dimmed off to show imagined action and to indicate the group from which attention is to be diverted. Use of a ring helps to identify the size of the original group. Two blocks of practice complete this part of the lesson.

Pages 98-99 introduce the four multiplication basic facts for 12. The pictures either show real action or suggest imagined action for the combining of equal groups. Use of a ring to identify a group of 10 is continued. The text stresses the various ways in which the multiplication idea can be expressed.

Both real and imagined action are again used in the pictures on pages 100 and 101, which present the four division basic facts for 12. Rings around groups are used for two purposes here. One purpose is to isolate a group of 10. The other is to show (for imagined action) the equal groups into which the original group is to be divided.

Work on the 12 group is completed on page 102 with a block of practice exercises devoted entirely to this group. There is also a block of mixed practice exercises on facts previously taught.

Teaching the whole class

Page 94: One way to introduce this lesson is to let children tell about going on picnics, deciding how much food to take, wrapping sandwiches and packing them, buying food to take along, making a cake, and so on. Let them tell briefly of any wildlife encountered. Then direct attention to Movie A. After the children have looked at the two scenes and read the adjoining text, have them take turns in relating each sentence of text to the movie. Let someone explain the purpose of the ring in the second scene and have another child tell how many a group of 10 and a group of 2 make. You might then call on someone to write the completed equation on the board.

Treat Movies B and C in a similar way.

As an additional activity, pupils may take turns inventing story problems that use these three facts.

Page 95: Let the class look over the page and discover that for each problem there are two equations and that each set of equations contains a fact and the reverse of this fact. Then handle the four movies and their accompanying text in the way you did Movies A, B, and C on the preceding page. Draw attention to the dotted backgrounds indicating the imagined action of combining.

To make sure the children understand the basic facts presented on this page, make up problems involving real action for each of the seven basic facts taught. Give them orally to the class, one by one, and have one child use objects to reproduce the problem situation and show what happens. Let him also state the basic fact.

Page 96: Let the class look over the page and discover, by studying the pictures, whether the page is concerned with addition or subtraction. Let pupils take turns explaining the "taking away" situation in each movie. Note that in Movie D the action is imagined, and the clue to this is the dimming off of 7 popcorn balls in the second scene. Have children relate the scenes of each movie to the appropriate text, just as they did with the addition basic facts on pages 94-95. When each fact has been discussed, call on a child to complete the equation. In conclusion, let one of the abler pupils make up a story problem for the equation $12-7=5$. Let him supervise the dramatization of this problem while the other pupils use objects.

Page 97: Use the teaching method suggested for the preceding pages for Movies E, F, and G and their accompanying text.

Exercises A to P in the first block may be done orally first, and then written. The complete equation should appear in the written exercise, opposite the proper letter. The second block of exercises (A to P) may be handled in the same way. If some children have trouble with Exercises I to P in the second block, let them work out the answers with objects. You may need to remind them that the first thing to discover and write down is the equation.

Page 98: When the children have looked over this page as a whole, let them describe briefly what they see on the page. Then direct attention to Movie A. You might ask:

How many branches have birds on them in the first scene? How many birds are on each branch? Is there an equal group of birds on each branch?

Let the children discover what is happening in the second scene and get someone to explain why the action suggests multiplication. Let someone tell what has happened in the last scene. Let another child tell how many birds there are in all, explaining how he knows there is this number of birds. You might then say:

Let's make an equation for this story. In the second scene, three groups of 4 birds are flying toward the same place. Is "3 fours" another way of saying this? The last scene shows that 3 fours equal how many? What is another way of saying 3 fours? [*3 times 4*]

Then ask someone to give the complete equation.

Ask the children to look next at Movie B and to decide whether or not anything is really happening in this picture. Guide them toward saying that they can *imagine* something is happening. Call attention to the first two scenes. You might ask such questions as these:

How many groups of butterflies do you see in Scene 1? [*6*] *How many butterflies are there in each group?* [*2*] *What does the dotted background in*

the second scene suggest? [*that groups are to be imagined as one big group*]

Let the class imagine these six groups of 2 as one big group. Have them look next at the last scene to find out how many there are in all. Discuss the meaning of the ring and ask how many butterflies are outside of it. You might also ask "6 twos equal how many?" and then call on a pupil to say this as an equation. Note that because of the imagined action in this movie and in the following one, it may be necessary to caution the children against mistaking the problem for one in addition.

Movie C may be taught in the same way. For the two basic facts illustrated by imagined action in Movies B and C ($6\times2=12$ and $4\times3=12$), ask some of the children to make up story problems in which something really happens to the equal groups. Have one or more of the children use objects to illustrate the situation, the action, and the result. Check their work to make sure that they have done the right things. Have the children state the equations for solving the problems.

Page 99: Let the children identify the animals pictured on this page and tell whether or not they have had any of these animals for pets.

You may then ask questions about Movie D similar to those asked for Movie A on page 98. Let the children read the text and take turns relating each sentence to a scene in Movie D. They are to supply any missing numbers as they read this text aloud. Stress the fact that all the expressions in the last three lines are ways of telling the story of Movie D.

For Movies E and F, have the children read the problems first, without the equations and statements. Tell them they can find the missing numbers in the problems by looking at the movies. In each case, let the children discover that they are to imagine the equal groups as one big group. Use questions similar to those outlined for Movies B and C on page 98. Afterward, call on pupils to read and complete the equations and statements beneath each of the problems.

When the work on this page has been finished, give the children some problems for the four multiplication basic facts just taught. If possible, let them use objects on their desks to show the situation, the action, and the result. Check their work to see that the proper number of equal groups are used and that they are moved together to make a group of 12. Have the children make and complete an equation for each problem.

Page 100: Have the children look at the page and let them discover that in Movie A there are 12 rabbits in the first scene. In the second scene these rabbits are beginning to hop away in groups of 4. In the third scene the 3 groups of 4 rabbits each are shown. Ask a pupil to state this story as an equation ($12\div4=3$). Write it on the board.

Help the children see that in Movies B and C they must imagine the separating of groups. The first scene of Movie B shows only a group of chickens. The second scene, with the ring, shows clearly that there is a group of 10 chickens and 2 more. In the third scene, to help the children imagine that the 12 chickens have separated into groups of 2, rings have been drawn around the groups of 2. Have the children focus attention on the *number* in each group first. Then have them count the number of groups. Call on someone to state the story of this movie as an equation ($12\div2=6$). Use the same procedure with Movie C.

Page 101: The children should read the text opposite Movie D and use the pictures to answer the questions. In the first scene of Movie D get the children to determine how many butterflies there are. Have them look at the second scene to see how many are in each of the groups that are flying away. Ask them how they know that this movie shows division. Call on someone to state the equation for this movie. Make sure they understand that the last two lines show different ways of telling the story of Movie D.

Ask the children to read the problem opposite Movie E first, omitting the statements and equation. Then ask them to look at the two scenes of Movie E. Get them to notice that the arrangement of the flowers is the same in the two scenes. Then focus attention on the first scene. Ask how the ring can be used to find, without counting, how many flowers there are.

Ask the children to read the first question in Problem E again. Tell them to get their answer from the first scene of Movie E. Then ask them to read the rest of the problem. Have them look at the second scene. Ask how many flowers are in each ringed group and if the groups are equal. Ask what separating into equal groups should suggest (division). Let someone tell how many groups of 6 flowers there are. Point out that since there are 2 groups of flowers, 2 vases will be needed. Have someone read and complete the last sentence of the problem. Then call on pupils to read and complete the statements and equations below the problem.

Movie F and its problem may be taught in the same way as Movie E and its problem.

Page 102: The two blocks of exercises A to V on this page may be gone over orally first. The children may take turns reading the exercises and giving the answers. Those who have trouble may use objects to

reproduce the situations and find the answers. Note that the first block contains all of the basic facts for the 12 group and that the second block includes previously taught basic facts.

When the two sets of exercises have been completed orally, have the children write the letters A to V in two columns on their papers and write just the answers.

Conclude the work on the 12 group by having someone read the statement at the end of the exercises.

The "Using arithmetic" problem set that starts on this page is discussed as a separate lesson.

Providing for the able pupil

If the children have been making the addition and subtraction basic fact charts described in Activity 2 (see page 313), have them supply the basic facts for the 12 group in the appropriate row.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 12 group. If equation cards are to be used, prepare them for the 12 group in advance.

Children will enjoy doing independently an activity that provides practice on the division basic facts for the 12 group and involves finding equal groups in 12. This activity builds upon the idea of imagined action introduced on page 100. For further instructions and some suggestions for variations, see Activity 29, page 325.

An egg carton with spaces for 12 eggs can provide a basis for a number of concrete experiences with the 12 group. See Activity 30, page 326, for specific suggestions.

Children may also work with 12 objects to find out how many 2's, 3's, 4's, and 6's are contained in 12.

102-103 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 87-88.

Expanded Notes are not considered necessary for these lessons.

104-108 Moving forward

Lesson Briefs for this lesson ore on poges 89-91.

Overview

This lesson presents the basic facts for all four processes for the 14 group. Page 104 teaches the five addition basic facts for 14; pages 105-106 teach the five subtraction basic facts; pages 106-107 teach the two multiplication and two division basic facts. The first block of exercises at the top of page 108 includes practice on all of the new basic facts. The second block of exercises includes previously taught basic facts.

Teaching the whole class

Page 104: You might begin this lesson with a general discussion of common experiences associated with the number 14 (such as the two-week or 14-day vacation, the length of time library books may be kept, the fact that if Father wears a vest there are usually 14 pockets in his suit, and so on).

Then let the children discuss the action in the two scenes of each movie, relating it to the text as they did when studying the 12 group on pages 94-97. Complete the work by having someone read the completed equation aloud. If necessary, let the children show action for Movies B and C.

The five basic facts presented on this page may be demonstrated in various ways. For example, you might draw on the board a group of 8 objects and a group of 6 objects and by making a shaded background indicate that the children are to imagine the groups as combined. You can have children draw a ring around a group of 10 in the combined group of 14 objects. Also, you can use real pennies or any other small objects that are available in the classroom and combine groups to make 14.

Page 105: The subtraction facts on this page may be handled in somewhat the same way as the addition facts on page 104. Emphasize, of course, the subtractive nature of the problems and pictures.

Page 106: Finish teaching the subtraction facts for the 14 group, using the method suggested for the preceding page.

If any pupils need further practice with these subtraction basic facts, let them act out Movies G and H, using objects. Let them circle 10 of the objects with a piece of string to help them see the large group of 14. They also may cover up the group they want to imagine as taken away.

Call attention to Movie I. Ask the children to tell what is happening in the two scenes. Ask:

How many ducks are there in each group in the first scene? How many groups are there? How many ducks are in the second scene? The ring around some of the ducks will help you. When two equal groups move together, what do you think of? What have you learned from what has happened in Movie I? Put what you have learned into an equation. Now read the story.

Say that there are several ways to write the story of the movie. Let a pupil read the statements to emphasize this. Have a pupil tell how the picture illustrates the equation.

Page 107: Let the children discuss the idea of imagining that the chickens go together into one group. Have a pupil explain the significance of the yellow background in the second scene. Finish by calling on another pupil to write the complete equation on the board.

Then direct attention to Movie K. You might ask the class if there is any difference between the birds in this movie and the chickens in Movie J. [One difference is that the birds in Movie K are wild birds and can fly away.] Let the children discuss each scene and relate it to the text. You might ask:

When you see equal groups flying away in the last scene, does it suggest division or subtraction?

Draw attention to the various ways of stating the basic fact, and then let a pupil read the statements, giving the answers. Have another pupil write the complete equation on the board.

Before working with Movie L, children who have parrots or parakeets might enjoy telling about them. Then ask someone how many birds are in the first bird cage. Let the children discover that the same number of birds are in the second cage. You may need to explain that the rings in the second cage mean that the birds are *imagined* as being separated into groups of 2. Ask why this should make everyone think of division. Then let pupils take turns reading the text, comparing it with Movie L, and in that way finding the missing numbers. Have someone write the complete equation on the board.

Page 108: For the first block of exercises (A to N), let pupils take turns reading the equations, saying the missing numbers. Call on the children to read the statements and equations in the second block of exercises (A to N) and give the answers. If any pupil has trouble, let him use objects to help find the answer. For Exercises A to G, ask the children to state the equations. Many of them may be able to give the answers directly from the statements. Then have the children write the answer to each exercise in the two sets opposite its identifying letter on their papers.

When the work for the 14 group has been completed, let a child read the statement at the end of the lesson.

A special activity for the whole class may be easily worked out by using a large classroom calendar. Let the children look at the calendar and see that there are 7 days in a week. Let the children each plan an imaginary two weeks' vacation. Point out that they will have 2 weeks of 7 days each, or 14 days in all. Let them suppose they will spend 8 days camping in the woods and the rest of the time visiting their relatives. Let them tell how many days they will be visiting relatives. Have the children make up other problems based on the vacation and using the number 14.

The pupils may use squares of paper on their desks to represent the 14 days of vacation. Let them remove some of the squares to represent days of their vacation that are past and then see how many days they have remaining. Let the pupils make up other similar problems, using these squares of paper to represent days.

Let a pupil suppose he will read a library book during his vacation. He plans to stay in the city and read his book. He can keep his book for 14 days, and suppose he has had it for 6 days. Ask how many more days he may keep it before he must return it to the library. Let the pupils make up other problems about a library book, using the number 14.

Providing for the able pupil

If the children have been making the addition and subtraction basic fact charts described in Activity 2 (see page 313), have them put the basic facts for the 14 group in the appropriate row.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 14 group. If equation cards are to be used, prepare them for the 14 group in advance.

108-109 Using arithmetic; Thinking straight

Lesson Briefs for these lessons are on pages 92-93.

Expanded Notes are not considered necessary for these lessons.

110-113 Moving forward

Lesson Briefs for this lesson are on pages 94-96.

Overview

The four addition basic facts for 15 are presented on page 110. Real action is used in Movie A; imagined action is used in Movies B and C. As in previous lessons, the dotted background indicates that the groups are to be imagined as one large group, and the ring identifies a group of 10 and makes it easy to see that the total is 15.

On page 111 the corresponding four subtraction basic facts for 15 are introduced. Movie A shows real action. In the other three movies, which illustrate imagined action, the group that is to be disregarded is dimmed off. In the first scene of each movie, a ring isolates a group of 10.

The two multiplication and two division basic facts for 15 are presented on page 112. The movies again

show real, and then imagined, action for each process.

Work on the 15 group is completed on page 113. The first block of practice exercises on this page is confined to those facts whose sums, minuends, products, and dividends are 15. The last block of work provides for mixed practice on facts taught up to this point.

Teaching the whole class

Page 110: Have a pupil read the statements beside the heading "Moving forward." Let the pupils look over the page. Then direct attention to Movie A. Ask:

What is happening in the first scene of Movie A? How many cupcakes are on the plate? How many is Mother putting on the plate? How many are on the plate in the second scene? How will the ring help you decide without counting how many there are?

Have a child read the text beside the movie. Tell him to refer to the second scene to find the number missing from the equation.

Have a pupil read the problem for Movie B and direct attention to the first scene of the movie. Get the children to identify June's oranges and Nancy's oranges and give the size of each group. Ask what the red dotted background suggests in the second scene. Now have a pupil tell how many oranges there are altogether in the second scene. Get him to explain how the ring helps him to see how many there are. Let a pupil read the story and the equations, saying the numbers that are missing. Point out that two equations may be written for this movie, because it does not matter which group is thought of as joining the other.

Treat Movie C in a similar way.

Page 111: Have the children look over the page and point out that all the movies on the page show food that can be found in a school lunchroom. Ask the pupils to find the movie in which something is really happening. Let a pupil tell what the action shows. Ask what the dimming off of milk bottles and fruit in Movies B, C, and D is supposed to suggest.

Direct all the pupils to look at Movie A. Ask:

How many apples are in the first scene? How does the ring around some of the apples help you to decide, without counting? What is happening in the second scene? How many apples will be left?

Have them read the story and the equation, supplying the missing number.

Continue with Movie B. Tell pupils to read the problem only. Then have them look at Movie B. Ask:

How many bottles of milk are there in all in the first scene? Now look at the second scene. You have already said that dimming off some of the milk bottles suggests subtraction. How many milk bottles are to be imagined as gone? How many bottles of milk are left?

Let one of the pupils read the text. Let another read the equation and say the required number.

Follow a similar procedure for Movies C and D.

Page 112: First conduct a discussion of the page in general. You might begin with remarks like these:

Have any of you ever seen a beehive like the one in Movie A? What is happening in Movie A? How many groups of bees are there in the first scene? How many are in each group? Are the groups equal in size? How many bees are on the hive in the second scene? When equal groups join to make one large group, what do you think of?

Have a pupil read the text, saying the number missing in the first line and answering the questions. Let another pupil read the various ways of expressing the basic fact $5 \times 3 = 15$, saying the missing numbers.

Next have the class look at Movie B. Ask:

Does this movie show something really happening, or are we to imagine that something is happening? The background in the second scene should help you to answer this question.

Then ask the children to read the problem and look at the two scenes of Movie B to answer the question and find the missing numbers. Have a pupil read the various ways of stating the basic fact $3 \times 5 = 15$, saying the numbers that are missing.

Suggest that the children look at Movie C. Ask a child to tell what the bees are doing. Ask a pupil to tell how many bees are in the first scene. Remind him that the ring will help him to see the number. Ask how many groups of bees are flying away and how many are in each group. Ask:

When you see bees leaving the hive in equal groups, what does it suggest?

Have a child read the story and supply the missing numbers. Let another child read the various ways of expressing the basic fact $15 \div 5 = 3$.

Call attention to Movie D and its text. Say:

Without counting the coins, see if you can tell how many pennies there are in the first scene. Now look at the second scene. The number of coins in this scene is the same as the number in the first scene. The rings mean that you are to imagine the coins separated into equal groups. What does this make you think of? How many coins are in each group? How many groups of 3 are there?

Have a pupil read the story that accompanies Movie D and supply the missing numbers. Then have a pupil go to the board and write the equation that expresses the story. Ask another pupil to read the various ways of expressing the basic fact $15 \div 3 = 5$.

Page 113: For the first block of exercises (A to L), let the pupils read the equations, saying the missing numbers. If any pupil has trouble, let him use objects to help him find the answer.

For the first part of the second block of exercises (A to F), you may ask the children to state the equations and then give the answers. Let those who would rather give the answers directly, try to do so; then, if they have trouble, suggest they put each statement into an equation first.

As a written supplement to this work, tell the children to write two sets of letters A to L in separate columns, then to write the answer for each exercise in each block of work beside the identifying letter.

When the exercises have been completed, tell the children to cover the statement at the end of the lesson with their hands and let a child tell what he thinks the statement will say. Then the children should read the sentences and see whether or not he was right.

Providing for the able pupil

If the children have been making the addition and subtraction basic fact charts described in Activity 2 (see page 313), have them put the basic facts for the 15 group in the appropriate row.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 15 group. If equation cards are to be used, prepare them for the 15 group in advance.

Continue using the cards described in Activity 8 (see page 317).

113-114 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons are on pages 96-97.

Expanded Notes are not considered necessary for these lessons.

115-118 Moving forward

Lesson Briefs for this lesson are on pages 98-100.

Overview

The addition, subtraction, multiplication, and division basic facts for the 16 group are introduced on pages 115-118. As in previous lessons, both real and imagined action are used in the pictures and the problem situations. Devices such as the dotted background, dimming off, a ring to identify 10, and rings to indicate imagined separation into equal groups all reappear on these pages.

The three addition basic facts for 16 are found on page 115, and the three corresponding subtraction basic facts are on pages 115-116. The three multiplication basic facts for this group are shown on pages 116-117. Page 117 also includes the three division basic facts for 16. The exercises at the top of page 118 provide practice on the facts for 16 and are followed by mixed drill on basic facts previously taught.

Teaching the whole class

Page 115: Point out that this block of work tells about earning and spending money. You might introduce the work on this page by letting children describe their own earning experiences.

Then let pupils discuss each scene of Movie A, relating it to the text. They can find the number missing from the equation by referring to the second scene of the movie. In discussing Movie B, draw attention to the dotted background in the second scene. Point out that two equations may be written for this movie, because it does not matter which group is thought of as joining the other. In discussing Movie C, let a pupil explain what pictured action shows that the scene is about subtraction rather than addition, and then finish the discussion of the movie and text in the customary way.

If any of the children have trouble understanding these basic facts, let them act out Movie B, using real or play pennies. For Movie C, have them put 16 pennies on a desk. Let a pupil remove 7 pennies and see how many are left.

Page 116: Let the children look over the page as a whole. Then have the problem for Movie D read and direct attention to the movie. You might ask:

How many dolls are in the first scene? In the second scene, how do you know that the dimmed-off dolls are those that Betty bought? How many did she buy? Which dolls did Carol buy? How many did she buy?

Let a pupil read the problem and equation aloud, saying the missing number.

Treat Movie E in a similar manner.

Ask the class to read the problem for Movie F and to look at the movie. Questions such as these might be asked:

What do you see in the first scene? How many flowers are in each box? Can you think of these flowers as 2 groups of 8? In the second scene, what has happened to the flowers? Why does this make you think of multiplication? After the two boxes of flowers have been planted, how many flowers are there altogether?

Let a pupil read the first four lines of the text, supplying the missing numbers. Point out that the change from "boxes" to "groups" does not affect the problem numerically. Ask another child to read the next

two lines of text, saying the missing number. A third pupil can read and complete the statement and equation in the last line.

Have the problem for Movie G read silently and call attention to the movie. Ask how the pennies are arranged in the first scene. Help the pupils to see that they are in groups of 2. Proceed as with Movie F.

Page 117: Have the text for Movie H read silently. Then direct attention to the movie. Have a pupil explain the two scenes and relate them to the text. Ask a child to read the text and equation aloud, saying the missing numbers.

Tell the class to examine Movies I, J, and K (all of which show division) and determine which shows real action and which show imagined action.

Have the children look at Movie I again, and help them decide that it shows division. Have the text read silently and then aloud, with the missing numbers supplied.

Have the class read the problem for Movie J and then examine the movie. By now the rings in the second scene should immediately suggest the imagined divisive action of the problem. Next ask a pupil to read the text aloud, saying the missing numbers.

Develop Movie K and its text in a similar manner.

Page 118: The first block of exercises (A to L) includes only the basic facts for the 16 group. Let the pupils read through the exercises in turn, saying the missing numbers.

For the first part of the second block of exercises (A to F), let the pupils write each exercise in equation form on their papers. Then let them read their equations in turn, saying the answers. Have the pupils also take turns reading aloud the equations in the second part of this block (G to L), giving answers. These exercises may also be used as written work.

Ask one of the pupils to read aloud the statements at the end of the lesson.

Providing for the able pupil

If the children have been making the addition and subtraction basic fact charts described in Activity 2 (see page 313), have them put the basic facts for the 16 group in the appropriate row.

Helping the slow learner

Activity 1 (see page 312) may be extended to include the addition basic facts for the 16 group. If equation cards are to be used, prepare them for the 16 group in advance.

A special activity that will give added practice for the 16 group is a game called "Spin-It." This is a simple game that all the children will enjoy making and playing. They not only will get excellent practice from playing Spin-It, but they also will get a good review of the basic facts for the 16 group while they are making the game. They can also adapt the game later on for special practice in mixed basic facts. Refer to Activity 31, page 326, for full instructions for making and playing the game.

118-119 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 100-101.

Expanded Notes are not considered necessary for these lessons.

120-123 Moving forward

Lesson Briefs for this lesson ore on poges 102-104.

Overview

There are only ten basic facts for the 18 group, all of which are presented on pages 120-123. It should be noted that the work on these pages concludes the presentation of addition and subtraction basic facts, since no basic fact has a sum or a minuend exceeding 18. Further work introducing basic facts in this book will be confined to multiplication and division with products and dividends through 36.

Teaching the whole class

Page 120: Call attention to the top of the page and ask a child to read the two statements beside the "Moving forward" heading. Then ask the children to read the text beside Movie A, omitting the equation. Have the class look at the movie. Ask:

Which group of boats belongs to Jack? Which boats are Dick's? Now look at the second scene. Since you are to imagine that the two groups of boats have become one group, how many are there altogether?

Let a pupil read the equation, saying the missing number.

Suggest that the pupils read the problem for Movie B. Ask them to look at Movie B to see if there are 18 airplanes in the first scene. Ask how many airplanes are dimmed off in the second scene. Ask how many airplanes are in bright color in this scene. Let a pupil go to the board to write the equation that tells what the movie shows. Let another pupil read the text and equation, saying the missing number.

Direct the pupils to read the problem that belongs with Movie C. Then have them look at the movie. Have the children find the nine different kinds of horns. Be sure they see that there are two of each kind. Have a pupil tell how many horns there are altogether. Let another pupil read the text, saying the missing numbers.

Page 121: Let the children look over the page in general. Then direct attention to the first problem. Tell the pupils to read it silently, looking at Movie D to find the missing numbers. Then have everybody again examine Movie D. Have them find the two different kinds of toy plates shown in the first scene. Tell them to look and see if there are the number of plates in each group that the problem states. Ask how many groups of 9 there are. Have the class look at the second scene. Ask:

Why do you think of multiplication here? How many plates are there altogether in the second scene?

Then direct a child to read the text and say the missing numbers as he reads. Ask another pupil to read the equation, saying the missing number.

Proceed with Movies E and F in a similar manner.

Page 122: Again let the children look over the page as a whole. Ask such questions as:

Look at the first scene in Movies G, H, and I. How many toys are in each? Now look at the second scene of each of these movies. What do the rings around the small groups suggest? [*Lead the children to say that they are to imagine the large group in the first scene of each movie divided into smaller equal groups.*] *When a large group separates into smaller equal groups, what does it suggest?*

Now direct attention to Movie G. Say:

You have already found out that there are 18 toy animals in the first scene. How many animals is the clerk going to put into each box? How many groups of animals are there? Dennis, write on the board the equation that shows what happened in Movie G.

Let a pupil read the text and equation, saying the missing numbers. Explain that he can use the pictures to get the missing numbers if he needs to. Be sure the children understand that 18 is divided by 9 because 9 animals are to be put into each box. The answer, 2, then represents the number of boxes the clerk will need.

Proceed with Movies H and I in a similar manner.

Page 123: Let the pupils read the problem beside Movie J and then look at the movie. Get someone to tell how many cars there are in the first scene. Ask how many are in each group in the second scene. Ask how many groups there are. Get a pupil to tell in his own words the story represented in the movie. Let him write on the board the equation that represents what has happened in the movie.

Have a pupil read the text and equation, saying the answers.

For Exercises A to P, let the children take turns reading each equation and supplying the answer. You also may use these exercises as written work, if you wish.

When the exercises have been completed, ask a pupil to read the statement at the end of the lesson.

Providing for the able pupil

If the children have been making the addition and subtraction basic fact charts described in Activity 2 (see page 313), have them put the addition and subtraction basic facts for the 18 group in the appropriate row. The children may be surprised when they realize there is only one addition basic fact for 18. The charts should now be complete. Take a little time with the group of children that worked on them to help them make the generalizations suggested in the complete notes for this activity on page 313.

As another activity for the able students, ask them to write the letters A to J on their papers. Then instruct them to write after each letter a different equation for the 18 group.

Since this lesson concludes the presentation of the addition and subtraction basic facts, some of the able students may enjoy summarizing their knowledge by making a table for the addition and subtraction basic facts. For details, see Activity 32, page 327.

Helping the slow learner

As a special activity, have one or more of the children make a Spin-It disk for the 18 group for the game described in Activity 31, page 326. If only basic facts for the 18 group are used, the facts will fill all but two sections of the Spin-It disk. You can make a variety of disks, each of which will contain a different selection of basic facts. Two disks can contain division basic facts only (there are 23 of them). Two disks can contain multiplication facts only. At this point the addition and subtraction facts should appear on the disks in mixed order. Include several disks with mixed facts from all four processes.

123-124 Using arithmetic; Thinking straight

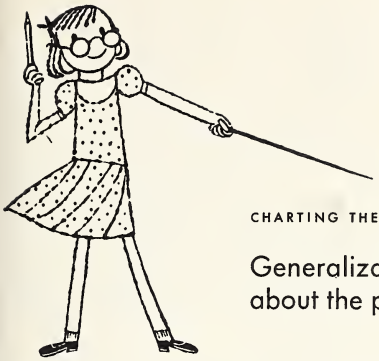
Lesson Briefs for these lessons are on pages 104-105.

Expanded Notes are not considered necessary for these lessons.

125 Checking up

Lesson Briefs for this lesson are on page 106.

Expanded Notes are not considered necessary for this lesson. See discussion of the use of tests in the Expanded Notes for page 36 on page 225 of this Teaching Guide.



CHARTING THE COURSE

Generalizations about the processes

In *Seeing Through Arithmetic 3*, pages 126-133 are devoted to several important generalizations. These are of two kinds. One type is useful in problem analysis, and the other type is used mainly in computation with number symbols.

Pages 126-127 help the pupils understand a problem that often arises in multiplicative situations. For example, if there are 4 vases, and 3 flowers are to be put in each vase, how many flowers are needed? In this situation the number of equal groups is the same as the number of vases. This can be shown by matching each group of 3 flowers to a vase. A demonstration with objects, then, would combine the 4 groups of 3 flowers each and produce a group of 12 flowers. This demonstration makes clear that the problem does not involve "vases times flowers" or similar confused notions. The general idea is that in many multiplicative situations the number of equal groups is determined by associating groups with some other object or idea, such as the number of vases to be used, the number of things to be bought at a certain price, etc. This situation is similar to the one that sometimes arises in problems that involve quotitive division. The latter was discussed earlier on page 257 in connection with pages 92-93 of *Seeing Through Arithmetic 3*.

Applications of the ideas discussed above are required in some measurement situations. In measurement situations, quantities are expressed in terms of a unit of measure. Some problems call for changing this unit to another that is larger or smaller. If the quantity is not very large or very small, it usually can be measured directly in terms of the new unit. Often, however, the direct method is inconvenient or impossible. Nevertheless, the problem is easily solved by arithmetic, and the principles are the same as those discussed in the paragraph above. For example, in changing the unit from quarts to pints, each quart is replaced by a group of 2 pints. Then the problem of changing 4 quarts to pints is a multiplicative one in which the number of equal groups is the number of quarts. However, if a quantity measured in pints is to be expressed in quarts, each group of 2 pints corresponds to one quart. This problem calls for quotitive division of the number of pints, but the answer is expressed in terms of quarts. Pages 128-129 of *Seeing Through Arithmetic 3* show pupils how the groupings are made, and help them to decide when to multiply and when to divide.

One of the most important generalizations in computational arithmetic is that the sum in addition is not changed if the same numbers are taken in a different order. For example, both $5+4$ and $4+5$ represent 9. The generalization is often stated as "addition is commutative," but this term should not be used with the pupils. One use of this generalization is in checking addition. It is customary to check by adding a column of figures in the direction opposite to that used originally in getting the answer.

In multiplication the product of two numbers is the same regardless of the order in which they are taken. For example, both 5×4 and 4×5 represent 20. If a problem leads to the equation $6328\times5=\square$, it is convenient and customary to arrange the work as in (b) rather than as in (a).

(a) $\begin{array}{r} 5 \\ \times\ 6328 \end{array}$ (b) $\begin{array}{r} 6328 \\ \times\ \quad 5 \end{array}$

This change of order of the factors from 6328×5 to 5×6328 is permissible in the abstract. It should be noted, however, that in a concrete situation each order represents a quite different grouping of objects.

Another set of generalizations in arithmetic deals with the "inverse" relations between processes. For example, addition and subtraction are inverse processes. If 4 is added to 5, the result is 9. If 4 is subtracted from 9, the result is 5. Multiplication and division are also inverse processes. Thus $4\times3=12$ and $12\div3=4$. Knowledge of these relationships is useful in both problem analysis and computation.

Many children become aware of the generalizations discussed above as a result of their experiences in learning the basic facts. However, all pupils should have these understandings, and hence some explicit attention to the generalizations is desirable. This is the purpose of the block of work on pages 126-133.

126-127 Exploring problems

Lesson Briefs for this lesson are on pages 107-108.

Teaching the whole class

To start this lesson, you might ask the children if they have bought anything for themselves lately. Let them describe their purchases. Then direct their attention to the problem opposite Movie A. Tell them to read just the three lines of the problem to themselves. Then tell them to look at the first scene of the movie. Ask:

What does Dick want to buy? How much does one candy bar cost? Now read the two lines opposite the first arrow. What does the picture opposite these lines show? Now read the two lines opposite the second arrow. Everyone look at the picture. How many candy bars do you see? What has been put with each candy bar? Why? How many groups of 5 pennies are there? If we put the three groups of 5 pennies together, would we find out how much the three bars would cost? What do we call combining equal groups? So our equation should have what sign in it? We want to know what 3 fives are. Who will write 3 fives as an equation on the board? Now look at the equation in the book. Is it like the one we made? What does the 3 stand for? [*3 groups of pennies*] *The 5?* [*the number of pennies in each group*] *Read the two lines below the equation.*

The next problem should be taught in somewhat the same way. By suggestions help the children see that the size of each group is determined by the statement about the flowers, and that the number of groups is determined by the statement about the number of vases.

Page 127: To start the work on this page, ask the class to read Problem A silently. Then call on someone to read it aloud. Ask:

How many boxes did Tom use? How many cars did he put into each box? What number tells the number of groups? Point to it in the equation below the problem. What number tells the size of each group? Point to it in the equation. How do you know that you should multiply to find how many cars Tom put into the 2 boxes? What number belongs where the screen is in the equation?

Call on a pupil to read the last two lines, saying the missing number.

For Problem B, have the children read only the problem first. Then proceed as in Problem A.

Explain that the three lines labeled "Think" in Problem C are put there to help pupils understand what the problem is about. Ask which numeral stands for the number of groups and which stands for the size of each group. Have the problem read silently by the class and then read aloud by one pupil. Let another pupil read the equation and supply the answer.

Discuss Problem D in a similar way.

Assign Problems E to J as written work. Tell the children that, if they need to, they may use objects to help them make the proper equations. They should write each equation twice, first with the screen or square and then with the answer inserted. Or they may write the answer in the square or over the screen instead of rewriting the equation. When all have finished, provide answers and let them check their own work. Then call on children to place their work on the board. Let some of the children explain why they made their equations as they did.

Providing for the able pupil

Cards with problems on them involving multiplicative situations in which the size and number of equal groups are disguised by the language used to describe the situation, should be prepared for use as independent work. See Activity 33, page 328. Do not include problems which use the expression "times as many as." These problems are taught in later grades.

Activity 14 (see page 320) may also be used.

Helping the slow learner

Let children who are having difficulty solving these multiplication problems also work with the problems on cards. Allow them, however, to use objects in working out the solutions.

128-129 Moving forward; Keeping skillful

Lesson Briefs for these lessons are on pages 108-109.

Teaching the whole class

Page 128: To set the stage for the work on this page, you can start a discussion about dairies. Ask questions similar to these:

What is a dairy? Have you ever visited a dairy? What is sold there? What size bottles or cartons do they put milk and cream in? Do you get pints or quarts of milk at home? Have you ever seen your mother measure milk in cups? Does she measure other things at home? Name some of the things you have seen her measure. What do you think she would use to measure a table top? Would she measure it in yards, feet, or inches? Open your book to page 128 to learn more about measures.

Have the children read the problem opposite the first scene of Movie A silently. Then have someone read it aloud. Have the pupils look at the first scene. Remind them that the bottles pictured hold quarts. Have them look at the second scene of Movie A. Then call on a pupil to read the sentence opposite the second

scene. Ask the pupils how many pints are equal to one quart. Explain that the quart bottle has been dimmed off because the 2 pint bottles are thought of as replacing the 1 quart bottle. Ask another pupil to read the first line opposite the third scene. Ask pupils to look at this scene and explain what has been done. Ask how many groups of two there are. Ask how they can find how many there are in all. Next call on someone to read the equation in the book and the sentence that follows it. Ask what the 4 stands for and what the 2 stands for. [The 4 stands for the number of groups; the 2 for the size of each group.] Then have someone read the remaining two sentences aloud.

For the problem accompanying Movie B, say:

Read the first two lines. What do you see in the first scene of the movie? How many pints are equal to 1 quart? Do you know how many pints there are in all? Now read the sentence opposite the second scene and see what the picture shows.

Explain why the 2 pint bottles are dimmed. [The quart bottle is thought of as replacing the 2 pint bottles.] Call on someone to read the first sentence opposite the third scene. Tell the class to note the groups of two in this scene. Get them also to note the 1 quart bottle that has been put with each group of 2 pints. Then have them look at the equation. Ask why they can divide. Ask what the 10 stands for [the total number of pints]. Ask what the 2 stands for [the size of each equal group]. Have someone read the remaining sentences, supplying answers. After the first sentence has been read, point out that the 5 shows the number of equal groups. Have pupils count the number of groups of 2 pints and then the quarts pictured in the illustration at the left to verify the answer.

As an additional activity, two children may demonstrate, with pint and quart bottles (or oaktag replicas), the solution to each problem on this page. After they have finished the demonstrations, ask a pupil to write on the board the equations that show how to solve the problems by arithmetic.

Page 129: Ask the children to read the first line of Problem A. Ask:

One yard is equal to how many feet? You should think of each yard as a group of how many feet? How many groups of 3 will there be? Read the equation and the explanations. The 6 stands for what? The 3 stands for what? Why do we multiply? Read the last two lines and think of the missing numbers.

Problem B may be solved first by the use of pint and quart bottles (or oaktag replicas). Then direct the children's attention to the explanatory material and ask questions similar to these:

How many pints are equal to 1 quart? How many pints are there in all? How can you find out how many equal groups of 2 pints there are in 14 pints? Now, if 1 quart is matched with each of these groups of 2, will we know the number of quarts? Look at the equation and explanations. What does the 14 stand for? The 2?

Have the children read the last two lines silently. Then call on a pupil to read them aloud, saying the missing number.

Let pupils take turns answering Exercises C to T. They may use objects if they need to do so. Then have all the class write the equations with answers.

As a separate activity, have the children write equations with answers for Exercises A to H in the first block under "Keeping skillful." For Exercises I to P in this block and for the second block of exercises (A to P), they may write just the answers.

Providing for the able pupil

The able pupils may be asked to make a list of all the measures they can think of that might be changed into some other measure. These measures should be written in a column headed "Measures to be changed." This column would include such items as "feet to inches," "pints to quarts," "yards to feet," "quarts to gallons," etc. In a second column placed opposite the first and headed "Groups to use," they should list the group that would be used in the reduction. For example, for "feet to inches" they would list 12; for "pints to quarts," 2; for "yards to feet," 3; for "quarts to gallons," 4; etc. Do not require the children to perform any of the reductions they list, since some of them will necessitate the use of computational skills that the children have not yet acquired.

Helping the slow learner

The children may use a yardstick and a foot ruler to find the number of feet in 6 yards. Suggest that first they mark off 6 yards by laying the yardstick on the floor with one end at the starting place. They should then put a chalk mark at the other end of the stick. Next they should pick up the yardstick and put it down again and make another mark. This is to be repeated until they have 6 marks. Next ask how many feet are equal to 1 yard and tell the children to mark off the number of feet in each of the yards just drawn. Have them use chalk different in color from the one previously used. Now ask how they can use what they have drawn to find how many feet are equal to 6 yards. Let them count the foot lengths, if necessary, to find the answer.

Another plan is to use yardsticks and foot rulers instead of making marks on the floor. Six yardsticks and 18 foot rulers will be needed.

130-133 Moving forward

Lesson Briefs for this lesson are on pages 110-112.

Teaching the whole class

Be sure to read the section called "Charting the Course," page 267, before proceeding with the work on pages 130-133.

Page 130: Before the children turn to this page, have them tell about some of their experiences with farm animals. Tell them that on the pages with which they will be working they will see pictures of some things that might be seen in the country.

Have the children look at the pictures across the top of page 130. Explain the arrangement of the pictures. The first picture shows two groups of boys. One group has a football; the other group has a kite. The first small picture shows the group of 4 joining the group of 5; the second shows the group of 5 joining the group of 4. The final picture shows the group of 9 that results from either of the two combining actions. Ask how many boys are in the group with the ball and how many boys are in the group with the kite. Then proceed by asking:

What is happening in the top middle picture? What does the larger picture at the right show? How many boys are there altogether? Tell the story of what happened. Read Exercise A below. Now look at the pictures again, starting at the left. How many boys are in the group with the ball? How many are in the group with the kite? Look at the lower middle picture. How many boys are in the group that is running? Toward what are they running? Look again at the last picture. How many boys are there altogether? Tell the story of what happened. Do you see that in each movie the answer is 9 boys? The answer is the same whether 4 boys joined 5 boys or 5 boys joined 4 boys. Read Exercise B below. Now you know that $5+4=9$ and $4+5=9$. Does it make any difference in the answer whether you add 5 to 4 or 4 to 5?

Now direct attention to Movie C, and ask:

How many dogs are in the larger group in the first scene? How many are in the smaller group? Let's imagine that the larger group joined the smaller group. Make an equation that tells what has happened. Now imagine that the smaller group joined the larger group. Make an equation that shows this. Read Exercise C. Do these two equations show what happened in Movie C?

Teach Movie D in the same way.

Exercises A to H at the bottom of the page may be done orally first. Let seven children take turns doing these exercises. Exercise A is an example of what is to be done. Afterward, tell all the children to write both equations for each exercise. Tell them to write the numerals that belong in place of the screen in each equation.

Page 131: Let the children examine the movies at the top of this page. Explain how they are to be used. The two scenes labeled A show, first, three equal groups of ponies and, second, these same groups of ponies running toward a pile of hay. The two scenes labeled B show the same action, but the size and number of the equal groups are different from those in Movie A. The large picture at the right represents the final result of the combining action shown in both movies. Proceed somewhat as follows:

The same ponies are shown in both Movie A and Movie B. Look at the first scene of Movie A. How many ponies are in each group? How many groups are there? What is happening in the second scene? Why does this make you think of multiplication? The big picture at the right shows the three groups of four ponies together in one group. How many ponies are there? Now read Exercise A, saying the missing numbers.

Look at Movie B. How many ponies are in each group now? What is happening in the second scene? What does this make you think of? [multiplication] How many ponies are there altogether when the four groups of three ponies have come together? Read Exercise B. What is the answer when three groups of 4 come together? What is the answer when four groups of 3 come together? Is the answer for 4×3 the same as the answer for 3×4?

Proceed in much the same way for Movies C and D and Exercises C and D. Focus attention on the equality of the groups and the combining of these groups.

Use Exercises A to M first as oral and then as written work. Exercise A is an example of what is to be done.

Page 132: Have children look at the first two scenes of Movie A. Call on a pupil to tell what is happening in the first scene and what the second scene shows as the result. Have him state the story as an equation [$5+4=9$]. Ask how many birds there are altogether. Then ask what the last scene shows. Ask how many birds will be left when 4 birds have flown away. Then ask someone to state this story as an equation [$9-4=5$]. Continue somewhat as follows:

Do you see that when you have put 4 with a group, you can then take 4 away and have the same group that you started with? Do you see that you can "undo" what you have done? You can say that 5 birds plus 4 birds equal 9 birds and that 9 birds minus 4 birds equal 5 birds. [Have one child read

Story A aloud, saying the missing numbers.] *Do you see that 5+4=9 and 9−4=5 "belong together"?*

Movie B may be handled in the same way.

Both blocks of exercises (A to L) should be treated orally first. If any of the children have difficulty, ask questions like these (see Exercise F in the first block):

8+9 equals how many? You have a total group of 17. Remember that you added 9 to the number you started with. What number should you take away from 17 so that you will have the same number left that you started with?

Finally, ask the children to write both sets of exercises, writing the complete equations for the related addition and subtraction facts after the appropriate letters.

Page 133: Direct attention to Movies A and B. Get the children to observe that in the first scene of Movie A, equal groups of birds are flying together to make the group shown in the middle scene. Then in the third scene this same group of birds is broken up into the same equal groups that were shown in Scene 1. Together these scenes illustrate how division is the "undoing" of multiplication. Continue as follows:

How many birds are in each group in the first scene? How many groups are there? Are the birds coming together or separating into groups? Why do you think of multiplication here? Are the birds together in the second scene? How many birds are there?

What is happening in the last scene? How many birds are in each group? How many groups are there? What is the difference between what the birds are doing in Scene 1 and Scene 3? [*In Scene 1 they are coming together; in Scene 3 they are separating into groups.*] *Read the first two lines of Exercise A. These lines describe what scenes of Movie A? Read the last two lines of Exercise A. They describe what scene of Movie A?*

Teach Movie B and Exercise B in the way described for Movie A and Exercise A.

Use both blocks of exercises (A to L) as oral work first. The first three examples in the first block are completed to show what is to be done. Later assign each set of exercises as written work.

To help the children see how the work in the entire lesson has helped them know *more* about numbers, ask them to look at all the pictures on the four pages again. Ask questions that will get at the desired generalizations. For example, for Movies A and B on page 130, ask them what number group they are learning about. Have them state the two addition basic facts. Then ask them to look at Movie A on page 132. Ask them what they learned about 9 here. Ask them to make a story about 4+5 similar to the one here about 5+4.

Providing for the able pupil

Pupils were taught most of the addition "pairs" of the teen groups by means of lessons using imagined action, with both members of the pairs taught together. The addition facts through the 10 group, however, were taught by real action, and therefore it might be well to give a little more attention to the pairs through the 10 group. Since all the addition basic fact pairs through the 10 group (for example, 4+6 and 6+4) are not presented on page 130, it might be well for the able pupils who have time to spare to turn to Tests 1 and 2 on page 36. Tell them to write each equation with its answer, and after each one to write its reverse. Then, when page 131 on the multiplication reverses has been finished, have the pupils turn to Test 5 on page 36 and try the same activity.

If practice cards with the basic facts through the 18 group are available (see footnote to Activity 8, page 317), they may be used for an activity of pairing basic facts and showing relationships. Four different activities may be carried out: pairing addition basic facts whose addends are reversed, pairing multiplication basic facts whose factors are reversed, pairing addition and subtraction basic facts, and pairing multiplication and division basic facts.

After deciding which basic facts you want the children to practice, place the pack of basic-fact cards (with the side without the answers facing the child) in a central place and let the children take turns drawing cards. Ask the child, as he draws his card, to read the statement and give the answer, then place his card on the chalk ledge. Then have the next child write the reverse basic fact on the board above it. Tell him to read this after he has written it.

Activity 34 (see page 328) may be used at this point to reinforce the reverse facts.

Helping the slow learner

The slower children may need to use objects in studying the relationships presented in this lesson. For example, have them put on their desks enough objects to show the group of birds on the ground in the first scene in Movie A on page 132. Then have them put down objects to show the group of birds flying. Next ask them to move the second group over to join the first group, as shown in the picture. Check the children's work at each stage to see that they have the right groups and perform the correct action. Then ask someone how many objects he has altogether in one group. Now tell the children to take away the group they just moved to join the first group. Then ask how many are left. This activity may be repeated for the

facts until the children see, for example, that $11-4=7$ may be thought of as the "undoing" of the basic fact $7+4=11$.

The game of Number Checkers will give children practice in working with the addition "pairs" of the 10 group. For this game a special board should be made of oaktag. See Activity 34, page 328, for details.

CHARTING THE COURSE

Finding the size of equal groups

The two main types of divisive situations were briefly discussed on page 215. The quotitive or "measurement" type has been used to teach the division basic facts that have thus far been introduced. Pages 134-138 now provide a careful introduction to problems of the partitive type. In this type the number of objects in the whole group is known, and the number of equal smaller groups to be formed from it is also known. The number of objects in each group (the size of the group) is to be found.

Children solve simple problems of this kind when they share something, such as a bag of candy, equally among a group of playmates. In such a case the objects are usually distributed one by one until all have been given out. The number each child has received can then be found by counting. The size of the equal groups is thus determined.

In quotitive situations the equal groups can be formed *group by group*. In partitive situations this cannot be done because the number in each group is not yet known. For example, suppose 147 pieces of candy are to be shared equally by 3 children. The 3 equal groups cannot be formed immediately because the number of pieces to go into each is not yet known. However, a group of 3 pieces can be set aside (one for each child), and this can be repeated until the candy is all distributed. The result is 49 groups of 3. The problem, however, requires these 49 groups to be arranged as 3 groups of 49 pieces each. This is easy once the number 49 is known.

The symbolization of a partitive problem requires careful attention. The situation above is represented by the equation $147 \div \square = 3$. Before division can be done, there must be a known number for the dividend and a known number for the divisor. The divisor, of course, is the number of objects in each of the equal groups. In partitive situations this number is not known and is the one to be found. Hence the divisor should be represented by a symbol (such as the screen above) that stands for the number to be found. In partitive situations the number of equal groups (the quotient) is known. The solution to the problem, however, is obtained by computation that involves the division of the number in the original group by the number of equal groups. In the example above, the *computation* is symbolized by $147 \div 3 = 49$.

The purpose of pages 134-138 is to help pupils understand problems of the partitive type. They cannot develop this understanding if they are told only how to do the computation. They must be given an opportunity to see not only how the problem is worked out with objects but also how the computation with number symbols produces the same answer. These pages are designed to guide their thinking.

134-138 Exploring problems

Lesson Briefs for this lesson are on pages 113-116.

Teaching the whole class

Page 134: Before starting work on this lesson, tell the children that they are going to learn something new about division. Remind them that up to now when they have divided, they have always worked such problems as "How many groups of 6 apples are in a group of 24 apples?" Now, however, they are going to learn to work some problems in which they must find how many to put in each group when sharing such things as candy, apples, etc. To give them some preliminary understanding as to how such a situation can arise, you might carry out the following activity.

Put 15 objects (pieces of chalk, large paper clips, or whatever else is available) into a box. Call one child to the front of the room. Say:

Let's pretend that the objects in this box are pieces of candy. You are to give them to the first five children in this row. Each child is to have the same number of pieces. How can you do this?

Continue with questions until some child suggests that, for a start, one piece of candy should be given to each of the five children. Continue somewhat as follows:

Give one piece of candy to each of the five children. How many pieces have you taken from the box? What should you do next? [*Give each of them another piece.*] *You have given away another group of how many pieces? Can you do this again? How many groups of pieces of candy are there? How many pieces are in each group?*

You may need to repeat this several times, using various dividends and changing the number of children who are to share the objects. Avoid remainders. Eventually, the children should see that to find the size of the group in these sharing situations, they must find how many groups of this size are in the larger group.

Now tell the children to open their books to page 134 and read the problem silently. Tell them not to try to answer the question yet. Have them read the sentence with the arrow pointing to the picture. Ask someone to describe what he sees in Picture A. Have them all note the large 12 and the text beside it. Tell them that this is the beginning of an equation that will describe what the problem says.

Next have the children read the first three lines of text opposite Picture B. Tell them to look at the picture and see what is happening. Ask the children why the division sign is needed in the equation. Get someone to explain what the screen stands for.

Call attention to the first four lines of text opposite Picture C. Have the children look at the picture. Then ask someone to read the equation and explanations aloud. Be sure to ask what number the screen represents. Then tell them to look at the next page, where they will see what Tom, Ann, and Carol had to do to divide the candy equally. Tell them that now they will learn how to solve the problem by arithmetic.

Page 135: Have pupils read the first statement and look at the 12 chocolates in Picture D. Then ask them to read the statements opposite Picture E. Call the children's attention to the 3 chocolates in the picture that are separated from the others and ringed. Say:

Each of these pieces of candy belongs to one of the children in the pictures on page 134. Let's say the first piece of candy belongs to Tom. Whom shall we say the second piece belongs to? And the third? Altogether, Tom, Ann, and Carol took a group of how many chocolates?

Now read the statements beside Picture F. Look at the picture. Point to the piece of candy Tom took this time. Point to the one Ann took. Point to the one Carol took. Have the children taken another group of 3 chocolates? Is it the group that is ringed?

Now read the statement beside Picture G and look at the picture. Point to the piece of candy each child took this time. Point out the group of 3 they took.

Now look at Picture H. Did each child take another piece of candy? Point to this group of 3. Now read the statements beside Picture H. Do you see why the 12 chocolates can be divided into groups of 3? Now turn the page.

Page 136: Have the children read the first sentence opposite Picture I. Have them look at the picture and note the ringed groups of 4. Say:

Point to the 4 chocolates Tom took. Point to the 4 Ann took. Point to the 4 Carol took. Now look at the equation we started with. Read what is said after it. Read what is beside Picture J. The picture shows the 12 chocolates in one group, just as the children found them. What do the rings show? Do they show the groups of candies each child took?

Now have the children read the new problem in the next "See" step. Have them look at Picture A. Call on someone to explain it. Make sure he points out that since there are two boys, there will have to be 2 equal groups of tablets. Then ask pupils to read the equation and text opposite Picture B. Call on pupils to explain what the 18 means, why the division sign and screen are there, what the number the screen is covering tells, and why the number of equal groups of tablets must be 2. Then tell the children to look at the next page.

Page 137: Have children read the first four lines of text opposite Picture C. Call on a pupil to point out the group of 2 tablets. Ask another pupil to name the boy he thinks each tablet belongs to. Ask the children to read the question again. Then have them look at the equation below it. Call on a pupil to answer the question about the screen. Then have the children read the text beside Picture D and think what the missing number is. Have them look at the picture and see if the 18 tablets have been divided into 2 groups of 9. Have someone point out Jim's tablets, then Bill's.

The three problems at the bottom of this page begin a practice set for the children to try. Go over the three problems orally. When the answers have been obtained by arithmetic, the children may act out the situations with objects to "prove" the answers.

This lesson is continued on the next page.

Page 138: Assign Problems D to N as written work. Tell children to write the letter for each problem, and after it to write the equation with the screen or a

square. Then they are to write what they should do, and give the complete equation with the answer. For example, the work for Problem D should look like this:

D $16 \div \square = 4$

Divide 16 by 4

$16 \div 4 = 4$

Afterward, provide answers and discuss each problem. Have pupils prove each answer by putting it in place of the screen in the original equation. If some children seem to need additional help, let them act out the problems with objects.

The "Keeping skillful" exercises may be used as separate work. Tell the children to write the letters A to T on their papers and write each equation, putting in the missing number. For the exercises with screens at the left of the equals sign, they should write what they should do first; for example, "Divide 12 by 2" for Exercise F. Then they should rewrite the equation, supplying the number that belongs where the screen is.

Providing for the able pupil

Partitive division problems can be included with the card problems suggested in Activity 33, page 328. Then give children cards for both the quotitive and partitive division types and tell them to separate the cards into two piles—those in which they must find the number of groups and those in which they must find the size of groups. Then tell them they are to write the equations and solutions for these problems.

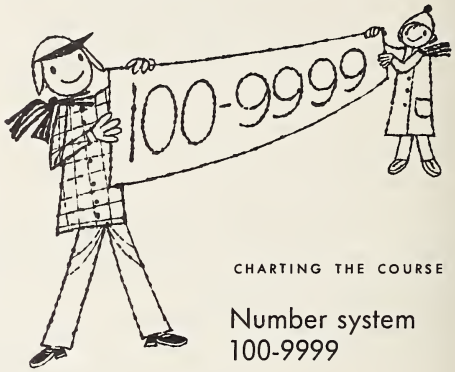
Activity 14 (see page 320) may also be used. Be sure to have equations of the type taught in this lesson, as well as those previously taught, included in the activity.

	To be divided	Among this many people	Write equation here	Show with tally marks	Completed equation
A	15 apples	5	$15 \div \square = 5$		$15 \div 3 = 5$
B					

Helping the slow learner

With the help of the abler students, prepare cards on each of which is given a problem situation involving partitive division. A card, when the child has filled it in, might look somewhat like the one shown at the bottom of column 1.

Let the slow learners take turns in working through each of these problem situations. First ask them to act it out, using objects. Then have them draw tally marks in the place designated, showing the groups found and their size. Finally, have them write the complete equation in its proper place.



CHARTING THE COURSE

Number system 100-9999

The basic principles of the number system were presented on pages 46-49 of *Seeing Through Arithmetic 3*. No new principles are involved in extending the range of numbers from 99 to 999, but the word *hundred* is introduced as the name of the group composed of 10 groups of ten. The group represented by the number 314, for example, is composed of 31 groups of ten and 4 single objects. When this number is read as "three hundred fourteen," however, it is viewed as composed of 3 groups of one hundred, 1 group of ten, and 4 ones. This kind of grouping is taught on pages 139-141 of *Seeing Through Arithmetic 3*.

Similarly, no new principles are involved in extending the range of numbers from 999 to 9999, but at the outset a new number word is introduced. This word, *thousand*, is the name of the group composed of 10 groups of one hundred. The number 1000 may also be viewed as composed of 100 groups of ten. The names of the numbers from 1000 up to 9999 are combinations of the word *thousand* and the names of smaller familiar numbers. In fact, no more new number words are needed to name numbers above 9999 until a million is reached.

On pages 142-143 of *Seeing Through Arithmetic 3*, the objective is not merely to help pupils learn to read and write four-figure numerals but also to help them visualize and understand the relationship of these numbers to the number system as a whole.

As noted earlier on page 228, the key to understanding carrying in addition and borrowing in subtraction is a thorough understanding of the number system. In *Seeing Through Arithmetic 3* the pupil is not asked to learn the principles underlying carrying and borrowing at the same time he is learning these processes. Instead, difficulties are reduced by first providing a very careful teaching of the principles as an aspect of the number system. Then carrying and borrowing involve mainly a direct application of these principles. Regroupings of the kind needed in carrying and borrowing are pictured and taught on pages 144-147.

On pages 148-151, our money system, which is an application of the number system, is extended beyond the work presented on pages 52-58.

Probably all children in Grade 3 have seen and handled $1 and $5 bills. Many children, however, may never have seen a silver dollar or a $2 bill. Their experience with $10 and $20 bills undoubtedly has been limited. Pages 148-151 extend the earlier lessons on money to include these larger amounts.

139-141 Moving forward

Lesson Briefs for this lesson are on pages 116-118.

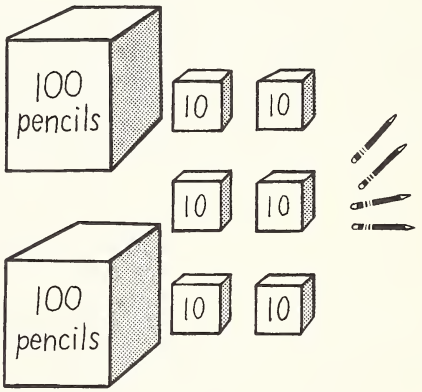
Overview

In this lesson children extend their knowledge of the number system (last studied on pages 42-49) to include three-figure numerals through 999. On page 139 they observe grouping by hundreds, tens, and ones and review the principle of place value in recording and reading these amounts. Tally marks are used on this page to record the number of each total group. On page 140, children learn to write the numerals for ones, tens, and hundreds in the appropriate position in a tally space and to read the resulting numeral. Page 141 provides practice in counting by hundreds as well as by tens, in reading three-figure numerals that have been written either in words or in figures, and in translating number words into numerals.

Teaching the whole class

Before the children open their books, a brief review of the number system as studied thus far may be helpful. Recall with the children first how they used tally marks for the decade numbers (page 42). To do this, draw a rectangular space for the tally marks on the board. Then, beside it, draw two boxes, each labeled "10 marbles," with 4 separate marbles at the right. Let a pupil tell you how many tally marks to write in the left section of the tally space and how many in the right section. Have him tell what figure to write below each group of tally marks, or let him make the tally marks and write the figures himself.

Now explain that a three-figure number may be described with tally marks in the same way as a two-figure number, but that one more section will be needed in the tally space. You can hold up before the class a picture you have drawn (see the illustration below) showing two large boxes, each labeled "100 pencils," six small boxes, each labeled "10 pencils," and four single pencils.



Discuss with the children how to draw a space with three sections for tally marks to represent the picture. Lead them to see that since there are three kinds of groups, they will need three sections in the tally space, one for each kind of group. After the discussion, request the children to draw a three-section tally space on their papers. (Or you may pass out papers containing one or more columns of three-section tally spaces that have been reproduced for the children's use.) Let someone explain which group (hundreds, tens, ones) each section of the tally space is for. Ask the children how many tally marks should be put in each section to represent the groups of pencils and single pencils in the picture you show them, and let them make these marks in their tally spaces. Then ask them to write, below each group of tally marks, the figure these marks represent. Call on someone to read the resulting numeral. It is all right if at this time he reads it as "2 hundreds, 6 tens, and 4 ones." The important thing is that he understands the groupings.

It would be helpful to use the *Arithmetic Readiness Cards, Set 2: The Number System** for introducing the three-figure numbers. There are eighteen three-figure examples in this set that show objects grouped in hundreds, tens, and single units. For each example the children may write the correct number of tally marks on their reproduced tally card sheets or in tally spaces they draw on paper.

Page 139: Now suggest that the pupils open their books. Ask someone to read the "Moving forward" statement, and then direct attention to Picture A. Let a pupil tell how many sticks there are in one of the piles. Help him discover that the pile is composed of 10 bundles, each of which is like the bundle at the right with 10 sticks in it. Have him count one pile by tens. If he does not know what to say next when he reaches 90, tell him to say "one hundred." Let the class discover how many sticks in all are shown in the picture. You might say, "Let's see how we show this number with tally marks." Then draw a three-section tally space on the board and let someone volunteer to fill it in. Ask the class to check this work and to make any necessary corrections. Then let another pupil read the resulting numeral. Say:

We could draw more tally spaces and fill them in with marks to represent each picture on this page. But we don't have to do this, because someone else has already done it for us.

Then direct the attention of the children to the tally spaces near the bottom of the page, explaining that six of these spaces may be matched up with the six pictures above. Ask:

Can anyone find the tally space that has the right number of marks in it for Picture A?

Then direct attention to the numerals at the bottom of the page and ask the children to find the numeral that represents Picture A. Let a pupil read this numeral aloud.

Continue in the same way for all the other pictures on the page, first discussing the picture and then matching it up with the correctly marked tally space and its corresponding numeral. You will want to pay particular attention to Picture C and to point out that since there are no tens, a zero must be put in tens' place.

Page 140: Let the children look over the page in general so that they may see that they will be thinking in terms of hundreds as well as tens and ones. You may want to review the method of making a tally space for three-figure numerals, making sure everyone understands that the space on the left belongs to the hundreds, that the middle space belongs to the tens, and that the space on the right belongs to the ones.

Suggest that the children look at Picture A. Let one child make tally marks to put in a tally space for the number of hundreds in the picture. Have the class continue by telling how many groups of ten there are in the picture, and how many tally marks should be made for the tens. Let the same pupil go to the board and make the tally marks. Now ask how many ones there are and let the pupil make them. Have the children count the tally marks in each section of the tally space and tell what figure to write below each section. Direct the children to look at the tally space in the picture and point out that they do not need to put tally marks in each section of this space, but that they can write a figure instead. Point out that the sections of the tally box are labeled "hundreds," "tens," and "ones." Have someone read the numeral below the tally space and draw attention to the way this numeral is written in words.

Picture B may be handled in a similar manner. Ask the class why a zero appears in the section that belongs to the ones, and ask why it is necessary to write a zero here, instead of leaving the section empty.

Direct attention to Picture C. See whether anyone can explain the whole picture by pointing out the group of 100, the group of 10, and the number of single paste sticks. Let him tell how to write what he sees in the picture in terms of figures in a tally space.

Let another pupil explain Picture D. You may want to point out how important it is to put the zero in the tens' section—in order to keep the figures for the hundreds and ones in their proper places when they are not in the tally space. Let a pupil read the numeral aloud.

Proceed in the same way for Pictures E and F.

Page 141: When the children look over this page, they may be curious to know how they are to use the two stairsteps of hundreds and tens. Tell them that in a little while they are going to play a game, using these stairsteps, but that there is something else you want them to do first. Then have a pupil count by hundreds, by saying the number of hundreds he finds on each line from A to I in the first set of stairsteps. Let another child count by tens by saying the number of tens he finds on each line from J to R in the second set of stairsteps.

Now tell the class that they may think of the boxes of hundreds and tens as part of a treasure hunt. Direct attention to the list of number words A to O at the upper right. Select a pupil to read the number words

*Arithmetic Readiness Cards, Set 2: The Number System, by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

after A in this list and tell him to find the row in the stairsteps for one hundred and the row for one ten. When he finds that the top row in each set of stairsteps will give him the number, ask him to read the two letters (A, J) of the two rows that make up 110. Tell him his score is 1. Let another pupil read the number words after B. Have him find his treasure by telling the letters of the two rows (I, O) that make up this number. Help him to see that he is looking for 9 hundreds and 6 tens. Each successful answer gives a score of 1. When Exercises A to O have been finished, the game can be continued by allowing the children to draw numbers from a box. The numbers should be in words on slips of paper. The child with the highest score wins the treasure hunt.

Slow learners may need to draw a three-section tally space on their papers and write the numerals in the appropriate positions. This will help them see for Exercise B, for example, the 9 in hundreds' place, the 6 in tens' place, and the 0 in ones' place.

Direct attention to the second block of number words (A to I). Let each child write the numbers in figures. Ask the pupils in turn to read the numbers aloud. Let the child first read his number by telling how many hundreds, how many tens, and how many ones it contains. Then let him read the number as it is written in the text.

Have the children read the numbers in the section labeled A to L.

Ask a pupil to read the statement at the end of the lesson.

An extra activity for all the class is based on the stairsteps. Let a pupil select a row from each set of stairsteps, calling out the letters that stand for each row. Then let him call on another pupil to say the number that the two rows represent.

Another activity for all the class is a Number Bee that gives practice in recognizing and reading three-figure numbers quickly. See Activity 35, page 329.

Providing for the able pupil

To give the pupils an exercise to emphasize that the same numeral can represent ones, tens, or hundreds and that the *position* determines what it represents, they may follow Activity 16 described on page 321 and carry out the activity to three-figure numbers. In other words, they may show the meaning of the numbers 111, 222, 333, etc., to 999, by making their own original drawings with tally marks and numerals.

Helping the slow learner

Less able pupils may need to practice grouping by ones, tens, and hundreds with objects such as cards in three sizes, labeled 1, 10, and 100. The relative sizes of the cards should be in reasonable proportion to the sizes of the groups. (A "10" card should be about ten times as big as a "1" card.) Picture cards such as those mentioned earlier in the lesson *(Arithmetic Readiness Cards, Set 2: The Number System)* may be used to show objects grouped in hundreds, tens, and ones, together with small cards with tally marks and numerals. The slow learner may make his own picture cards. He can pick a three-figure number and illustrate it by drawing the correct number of groups of 100 objects, 10 objects, and single objects. He can show his illustration to the class and explain it.

If the child is still having difficulty when the class has reached page 140, let him first think of the pictures on this page in terms of tally marks instead of as numerals. If necessary, he can draw a three-section tally space and put the proper tally marks in it. Then he can write the proper figure under each group of tally marks. Let him look at the tally space in the picture, compare it with the one he has made on his paper, and see whether he has the same three-figure number. Let him read the number. Call attention to the number as it is written in words in the picture.

Activity 18 (see page 322) may also be adapted to three-figure numbers.

142-143 Moving forward

Lesson Briefs for this lesson are on pages 118-119.

Overview

In this lesson children continue their study of the number system, extending it to four places. On page 142 the word *thousand* is introduced, and tally spaces which have been extended beyond hundreds' place to provide a fourth section for thousands are shown. Pictures illustrate the grouping of 10 hundreds to make one thousand. Page 143 provides children with further experience in visualizing a four-figure number and in learning what each figure in the number signifies. Practice is provided in reading four-figure numbers in both numerical and word forms.

Teaching the whole class

Page 142: After the children have had time to look at this page, they might enjoy a "pretend visit" to a neighborhood store and a discussion of the kinds of candy they like best. Ask if anyone has ever seen a big glass jar that looked as if it had a thousand pieces of candy in it, and then write both the words and figures for one thousand on the board.

Have a child read the "Moving forward" statement aloud, and then direct the attention of the class to Picture A. Discuss what is happening in this picture, how many boxes of 100 there will be altogether in the

completed pile, and explain that 10 hundreds equal one thousand. Let another child count the boxes aloud by hundreds. Someone else might be asked to point to the word *thousands* in the picture and to say the name of each section that appears over the 1 and the zeros in the tally space.

Then suggest that everyone look at Picture B. Call on a pupil to tell how many thousands there are in the picture and let another child find the hundreds. Ask the children if they can find any tens or ones in the picture. Then let someone volunteer to explain what each of the four figures in the tally space represents. You may draw a large tally space with four sections on the board and have the pupil write the figures in it.

The remaining pictures may be treated in the same way.

Page 143: Let the class look at the picture. Call on a pupil to tell how many thousands there are, how many hundreds, how many tens, and how many ones. Let another pupil read the numeral printed below the tally space. Then have a pupil read aloud Exercises A to D, and for each statement have him point to the figure in the tally space in the picture that illustrates the meaning. If you have made a large tally space on the board and labeled the sections for thousands, hundreds, etc., he may use this, so that the whole class may see the section he is pointing to. At the same time the other pupils may point to the correct sections in the tally space in their books.

Let pupils take turns reading Exercises A to K, saying the missing numbers. You may wish to have them make a tally space for each statement and fill in the numbers before they read the statements.

Next let the children take turns reading the numbers in Exercises A to R. Each number in Exercises A to M is to be written in figures.

Providing for the able pupil

The activity suggested for three-figure numerals (Activity 16, page 321) may be adapted for four-figure numerals.

Helping the slow learner

Let the children draw a picture to illustrate a four-figure number. Suggest that they write the number they choose at the top of their papers; then draw large squares to represent boxes of 1000. Have them label each square "1000." Have them draw as many as the thousands' figure calls for. Let them continue by drawing and labeling smaller squares to represent the hundreds and tens and, finally, single sticks or other objects to illustrate the number of objects the ones' figure calls for. Let them show their drawings to the class and let each child call on another member of the class to read his number.

144-147 Moving forward

Lesson Briefs for this lesson are on pages 120-122.

Overview

In this section children learn more about the principles of regrouping in the number system. By changing ones into tens, tens into hundreds, hundreds into thousands (and reversing this process—changing thousands into hundreds, etc.), children build a strong foundation for understanding carrying in addition and borrowing in subtraction. The work on pages 144-145 is preparation for carrying in addition. Regrouping is taught with the aid of pictures, tally spaces, matching exercises (in which pupils relate information in the pictures to statements they are required to complete), and exercises that may be used for either oral or written practice in regrouping. On pages 146-147, children practice regrouping as a basis for understanding borrowing in subtraction.

Teaching the whole class

Page 144: Ask a pupil to read the "Moving forward" statement at the top of the page. Then call attention to Movie A and ask if anyone sees any difference between the first picture and the last picture. Say:

Look at the second scene of Movie A. What is happening? [*Lead pupils to see that 10 of the 11 boxes of chocolates are being put into a larger box that will contain 100 chocolates, and that 1 box of 10 will remain.*] *What has happened to the chocolates in 10 of the small boxes? Where can you find them in the third scene of Movie A?* [*Help the children to see that the candy has been regrouped into a box holding 100 chocolates and that this box of 100 has been put with the other hundreds in the picture.*] *How many boxes of 10 chocolates are there after the new group of 100 has been formed?*

Have a child read the figures in the tally space in the first scene, telling how many thousands, how many hundreds, how many tens, and how many ones there are. Have another child read the figures in the tally space in the third scene of Movie A. Let someone explain what has happened in the tens' and hundreds' sections of the first tally space to make them read as they do in the second tally space.

Call attention to Movie B. Ask a pupil to tell how many groups of 1000 there are in the first scene. Have him also tell how many groups of 100 there are and how many tens and ones. Ask the class to look at the rest of the movie and tell what is happening. Help them to see that 10 of the groups of 100 have been regrouped to form a pile of 1000. Ask how many thousands there are in the third scene. Ask how many hundreds, tens, and ones there are.

Suggest that the pupils cover up the four-figure numbers in the first and third scenes of Movie B with a paper or book. Then draw a four-section tally space on the board and let a pupil tell what figures to write in the tally space to represent the groups of sticks shown in the first scene. Draw another tally space on the board and ask another pupil to tell what figures should be written to represent the groups of sticks in the third scene. Then let the children uncover the tally spaces in their books to find out whether they are the same as those you wrote on the board. Ask a pupil to tell why figures representing hundreds and thousands are different in the two tally spaces. Help the class see that the number of sticks is the same in both scenes, but that they are grouped differently. Ask a pupil to read the four-figure number below the second tally space of Movie B.

Now suggest that the class look at Movie C. Let a pupil tell how many hundreds, tens, and ones there are in the first scene. Ask how the ones have been regrouped in the second scene. Ask how many tens there are now that the ones have been regrouped. Direct attention to the third scene. Point out that the tens have disappeared and let someone tell what has become of them. Lead the class to see that they have been regrouped to form a new hundred. Ask how many hundreds there are now. Direct attention to the tally space in the first scene. Have a pupil explain how the figures in the tally space represent the grouping in the first scene. Let another pupil do the same for the second and third scenes of Movie C. Ask a pupil to read the number written in its final form below the last tally space.

Page 145: Let the children look at the three pictures at the left of the page that represent three-figure or four-figure numbers. Point out that they are to look for any group that contains more than 9 objects or boxes and thus can be regrouped.

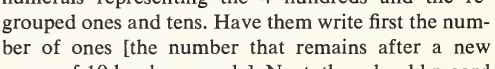
Suggest that the class look at Picture A. Ask them to look for a group that contains more than 9 objects or boxes. Ask how they might regroup the boxes of 100 chocolates and help them to see that a group of 1000 chocolates and two groups of 100 could be made from the 12 boxes of 100. Let them examine the picture again to discover whether any other regrouping can be done.

Ask the pupils to draw two four-section tally spaces on their papers. In the first tally space let them write numerals representing the thousands, hundreds, tens, and ones shown in Picture A. Next let them imagine that the candy has been regrouped. In the second tally space let them write the numerals that represent the regrouping. When the children write the figures in the second tally space, have them first write the number of ones, then the tens, then the hundreds that are left after 10 of the hundreds have been regrouped, then the thousands. Here is an example:

Ask a pupil to give the missing numbers in Exercise A at the top of the page. (Note that he first supplies the numerals that represent the groups shown in Picture A. He then mentally translates these individual numerals into the numeral 2223.)

Have the children draw three four-section tally spaces on their papers. Now direct attention to Picture B. Let the children write the number of hundreds, tens, and ones in the proper sections in their first tally space. Be sure they understand why the thousands' place is left empty. Now suggest that the children look again at the picture. Ask a pupil to tell how the sticks can be regrouped.

In the second tally space have the children write the numerals representing the 4 hundreds and the regrouped ones and tens. Have them write first the number of ones [the number that remains after a new group of 10 has been made]. Next, they should record the number of tens. [10] Now ask what should be done with the 10 tens. Let a pupil explain why he should write 6 for ones and a zero for tens in the third tally space. Let him tell how many hundreds there will be now. Have the pupils write the proper numerals in the third tally space to show the regrouping of the tens and hundreds. Ask a pupil to read the number. Here is an example of the three filled-in tally spaces:



Ask a pupil to read Statement B at the top of the page, saying the missing numbers.

Proceed with Picture C in the same way, and end the work by asking a pupil to read Statement C at the top of the page, giving the missing numbers.

Direct attention to Exercises A to Z. Have the children take turns reading the exercises, saying the missing numbers. If anyone has difficulty, let him use papers that have been prepared in advance with columns of four-section tally boxes on them, or let him draw his own tally spaces. Suggest that he write figures in his tally space to represent the exercise. Ask if the numbers can be regrouped. Then have him write the numerals the new way in another tally box and read the number aloud.

Page 146: Suggest that the children look at Movie A and read the number under the first tally space. Ask them to examine the first and third scenes closely and try to discover how the groups differ. Let someone explain what is happening in the complete movie. If necessary, help him to understand that a group of 10 is being separated into ones, and that in the third scene the ones have been put with the ones that were in the first scene. Ask a child to look at the tally space under the first scene and tell how many thousands, hundreds, tens, and ones there are. Then have the children cover the tally space under the third scene with their hands. Get someone to tell what numerals should be in each place now that one of the tens in the first tally space has been separated into ones and put with the original 2 ones. Let the children uncover this second tally space to see if the figures actually do represent the new grouping.

Continue in a similar way with Movies B and C.

Page 147: Direct attention to Picture A. Ask a pupil to tell how many of each group he sees in the picture. Call on someone to read Exercise A, saying the missing numerals.

Now let the class look at Picture B. Point out that there are the same number of sticks in this picture as in Picture A, but the arrangement of the sticks is not the same. Ask the children what is different about the arrangement of the sticks in these two pictures, and let someone explain what has happened to one of the groups of 10. Let a pupil read Exercise B, saying the missing numerals, which describe the arrangement of sticks in Picture B.

Now have the class discover that the number of sticks in Picture C is still the same as in Pictures A and B. Let everyone look at Picture C to find out how the sticks are regrouped this time. You might ask:

What has happened to the group of 100 sticks? How many tens are there now?

Let a pupil read Exercise C, saying the missing numerals that match the grouping of sticks in Picture C. Be sure he sees why there are no hundreds to put in the statement.

Then call attention to Picture D. Ask how many tens there are, and recall that in Picture C there was one more group of 10. Ask what has happened to this group of 10 in Picture D. Let someone read Exercise D, saying the missing numerals. If pupils need further help in visualizing the four-figure number as the groups have been rearranged, let them draw tally spaces and write the numerals that represent the grouping in each picture.

For Exercises A to Z, let the pupils use prepared papers on which columns of tally spaces for four-figure numbers have been reproduced. (Or let the children draw their own tally spaces.) In one tally space have them write the number as it appears the first time in the statement (at the left of the equals sign). In another tally space tell them to write the number according to the regrouping indicated in the statement. To help them do this, you might ask:

How would you read the four-figure number in Exercise A? How many thousands, hundreds, tens, and ones are there? Now write the number in one of your tally spaces. Look at the rest of the exercise. Write figures to represent this part in another tally space. Be careful to leave the space for the hundreds empty until you see how many hundreds you are going to have in this new arrangement. You know that the number is being regrouped because now there are 7 thousands instead of 8. A thousand is a group of how many hundreds? How can you regroup the missing thousand? If a thousand or a group of 10 hundreds is put with the hundreds you already have, how many hundreds will you then have altogether? What figure will you write in hundreds' place in your tally space?

Proceed similarly for the other exercises.

Let a pupil read the statement at the bottom of the page.

An activity that may be used here for varying numbers of children in the class is a Number Bee including four-figure numbers (similar to the activity suggested for three-figure numbers). See Activity 35, page 329. For four-figure numbers, make up a group of cards containing groups of objects to represent the figures of four-figure numbers. The game is played exactly the same as before. To give variety, the cards for the four-figure numbers may be mixed with the cards for three-figure and two-figure numbers. The abler children can help make the cards.

Providing for the able pupil

After the children have completed the work ending on page 147 (changing thousands to hundreds, hundreds to tens, tens to ones; also changing ones to tens, tens to hundreds, hundreds to thousands), the abler students may enjoy taking a number such as 3876 and writing it in tally spaces in several different ways without changing its value. For example, 3876 could be written:

Helping the slow learner

Have the children (as a group) cut out 19 small squares (about one inch square) and label each with the numeral 1. Then have them cut out 19 larger

squares (or strips of paper) and label each with the numeral 10. They can imagine it is a "box of 10." Similarly, have them make 19 still larger squares (or strips) and label these 100. Finally, have them make 9 (or fewer) larger squares and label these 1000. With these materials, have the children represent various four-figure numbers (for example, those in the book) by arranging the proper number of squares in piles on a desk or table. Then have them show the regroupings by moving groups from one pile to another. At any time a square of a certain size may be exchanged for 10 squares of the next smaller size, or 10 squares of one size may be replaced by 1 square of the next larger size.

148-151 Moving forward

Lesson Briefs for this lesson are on pages 123-125.

Overview

This lesson will be much more meaningful for the children if you can arrange to have on hand some coins, particularly those with which the children are less familiar, such as the half dollar and the silver dollar. A few real bills in some of the denominations shown in the play money at the bottom of page 148 will provide interesting material for discussion of differences—portraits, etc., as well as numerals.

The earlier work on money (pages 52-58) provided many experiences with equivalent coin values through the half dollar. In this lesson children learn equivalent money values for the dollar and practice counting, writing, and reading sums of money beyond one dollar.

Pictures A to E on page 148 show the equivalent money values of one dollar. This page also contains a full scale photograph of a silver dollar and shows (in play money) bills in denominations of one to twenty dollars. On page 149 children learn to count and read sums of money in excess of one dollar. Page 150 provides additional practice in counting and reading amounts of money and also shows the children how to write these amounts in figures, using the dollar sign and the point. Exercises for further practice are offered on page 151.

Teaching the whole class

Page 148: Have the children look at the page. Let them discover that the money in each picture from A to F is equal to 100 cents or one dollar. Have a pupil name the coins in the pictures.

If you can, show the children some real coins. You may have the children name them as they are passed around. Then let the class discuss what they can buy with each coin.

Suggest that the children look at Picture A. Let them determine how many coins there are in each group of pennies. Direct a pupil to count the pennies by tens. Ask which picture shows two pieces of money that are each equal to the 100 pennies in Picture A.

Let another pupil tell how many groups of nickels there are in Picture B. Ask how many nickels there are in each group, and how much each group is worth. Let him count by tens to find the value of the money shown in nickels. Have another child count it by fives. Point out that the 20 nickels and the 100 pennies are the same amount of money, that both are equal to 100 cents, and that 100 cents is a dollar. Indicate the dollar bill in Picture F.

Call attention to Picture C. Have a pupil count the number of dimes. Ask how many pennies one dime is worth. Ask how many nickels are equal to a dime. Explain that one dime is worth 2 nickels or 10 pennies. Let a child count by tens to find the value of the money shown in dimes. Ask what piece of money is equal to 10 dimes.

Suggest that the class look at Picture D. Ask what a 25-cent piece is called. Point out that the quarters in the picture are equal to 100 cents or a dollar. Ask how many quarters are equal to a dollar.

Call attention to Picture E. Ask what other name there is for a 50-cent piece. Be sure pupils know that the 2 coins, or 50-cent pieces, in the picture are equal to a dollar. Ask how many half dollars are equal to a dollar. Have a pupil count "50, 100."

Now have the class look at Picture F again. Explain that the silver dollar and the dollar bill will buy the same amount and that the money in each of the other pictures will also buy the same amount. The class might be interested to know that the paper dollar really represents a silver dollar or its equivalent and that the United States Government will give a silver dollar for a paper dollar.

Call attention to the pictures of other denominations of paper money. Show real bills, if possible. If time permits, encourage the children to discover the differences in design among the various denominations.

Page 149: Have the class look at Picture H. Ask a pupil to name the different coins in the picture. Let a pupil read the statement of value of each piece of money. Show him how he can count the money as he reads the values of the coins by saying, "1 dollar, 25, 35, 36," and finally, "1 dollar and 36 cents." Ask a pupil to read the text below the picture. If possible, have a dollar bill, a quarter, a dime, and a penny in the classroom. Ask a pupil to come to the front of the class while you count the money into his hand. Let

him choose another pupil and count the money into the other pupil's hand. Let several children do this.

Examine Picture I and proceed in the same way.

Call attention to Picture J. Suggest that a child count the money. Help him say, "1 dollar, 50, 60, 70, 71, 1 dollar and 71 cents." Let all the pupils write this on their papers. Ask them to write on another line the final statement of the total amount of money in the picture. They should understand that it should be "1 dollar and 71 cents."

Proceed in the same way with Pictures K to S. Let the children take turns counting the money aloud. All the children should write on their papers first what is said when the money is counted and, second, the final total amount.

Page 150: Explain that the class now will learn more about counting dollars and cents. They not only will count money, but also will learn how to read and write amounts of money.

Direct attention to Picture A and ask a child to count the money. Call attention to the statement and point out how the amount of money is written with numerals, a point, and a dollar sign. Write the dollar sign on the board. Let the children practice writing it on their papers. Write $1.10 on the board. Say:

This is the way to write 1 dollar and 10 cents with figures. The point separates the dollars from the cents so that we will know how to read the number of dollars we have and also the number of cents. The two numerals at the right of the point tell how many cents there are. The numerals at the left of the point tell the number of dollars.

Suggest that the children write $1.10 on their papers.

Proceed in the same way with Pictures B and C, having someone count the money and then letting all the children write the amount on their papers after it has been written on the board. Explain that because there always must be two places at the right of the point, 2 dollars and 5 cents must be written as $2.05. This can be made more meaningful to the children by first writing $1.10 on the board for a dollar bill and a dime that they see. Then change the dime for 10 pennies. Remove 1 penny and ask what is left. Change the numerals on the board to $1.09.

Have the class look at Picture D. Let a pupil count the money. Point out that there are three ways to write 85 cents and write all these ways on the board. Ask the children to write 85 cents in three ways on their papers.

Use the same procedures for Pictures E and F.

Ask the class to look at Picture G. Have a pupil count the money. Have the children write the amount of money, using the dollar sign and the point. Then have them write the amount in two other ways.

Follow a similar procedure for the rest of the pictures from H to O.

Page 151: Let the children take turns reading the amounts of money in Exercises A to Z in the first block of practice.

Call attention to Exercises A to M at the right. Ask a pupil to read Exercise A. Let him tell you how to write it on the board, using figures, the dollar sign, and the point. Ask all the children to write it on their papers. Direct the class to write all of these exercises on their papers.

Have the pupils take turns reading the exercises in the third block (A to N), saying the missing numbers. If possible, provide coins for the children to use in case they have trouble.

For Exercises A to N in the last block, let the children draw coins on paper if they need to.

Providing for the able pupil

The children can have a great deal of fun and practice in counting change by playing store with cards picturing grocery store ads. See Activity 36, page 329, for details.

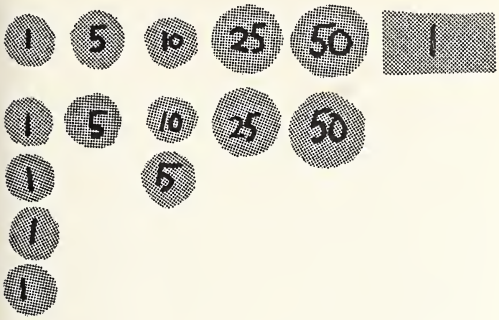
Helping the slow learner

The pupils can use the play money they made for an earlier lesson. Let them make more play money by drawing around real coins and then cutting them out until each child has 5 pennies, 3 nickels, 2 dimes, 2 quarters, 2 half dollars, 1 dollar. Direct them to line up coins in such a way that they have a row made up of one of each in the order of their value, beginning with a penny and ending with a dollar. Now let the pupils put additional pennies in a column below the penny to make the number of pennies equal to the next coin, the nickel—that is, they will place 4 pennies in a column below the one in the line. Then let them place enough nickels in the column below the nickel to equal the next coin, the dime—that is, they will place only 1 nickel below the one at the top.

Next, the pupils are to place in the column below the dime, the necessary number of nickels (or dimes and nickels) to make the equivalent of the next coin, the quarter. (Three nickels or 1 dime and 1 nickel will be placed below the dime in the line.) The pupils should now see that they need to put another quarter below the first one to equal the next coin, the half dollar. They will then put another half dollar below the first one to equal the next coin, the dollar.

Then have the children draw, in another color, above each group of coins, the coin that is equivalent to the coins below. Above this another row can be added, etc. The children's pictures should begin like

the chart shown below. Be sure to check the children's pictures for accuracy, so that they can use the chart for quick reference if they have difficulty remembering the value of the various coins.



Suggest that the pupils keep this chart for reference with Activity 37, page 329. The chart will help them see at a glance the progressive values of coins. Also pupils can refer to it to help them make change. Activity 37 describes how to play store with picture cards and how to make the picture cards.

152 Checking up; Keeping skillful

Lesson Briefs for these lessons ore on poge 126.

Expanded Notes are not considered necessary for these lessons.

CHARTING THE COURSE

The addition process

In *Seeing Through Arithmetic 3* no computation is required of the pupil until he has learned the basic facts. When fully mastered, the recall of a basic fact is a purely mental response and is not considered computation. The introduction of all the addition and subtraction basic facts was completed on page 123. Instruction on the computational process for addition begins on page 153.

The first ability to be acquired is to add a one-figure number to a two-figure number. Skill in this process is necessary for efficiency in column addition.

Skill in the process means that the pupil can do the addition mentally with speed and accuracy. Of course, skill is usually not acquired all at once—it takes time and practice. Moreover, it should not be expected until the pupil understands the process.

Pages 153-155 are designed to help the pupil acquire this understanding. The addition of a one-figure number to a two-figure number has been traditionally divided into several smaller units, including "adding by endings" and "bridging." By bridging is meant recognizing that in certain instances the sum of a one-figure number and a two-figure number will be in the next decade, immediately stating the decade name, and then proceeding to determine the "ones" figure in the sum by giving attention to the "ending." The assumption has been that when such responses have become skilled, this process will be performed accurately and speedily. When teaching methods are based mainly on stimulus-response theories of learning, extensive practice or drill is needed to develop this skill.

Seeing Through Arithmetic 3 emphasizes *insight* on the part of the pupil. The first consideration is that the pupil understand what is happening when a one-figure number is added to a two-figure number. The primary thing to be learned is a principle or method of attack, not a host of individual facts. Once an understanding of the method of attack has been acquired, there are almost innumerable opportunities for practice in connection with column addition of one-figure and two-figure numbers.

Adding a one-figure number to a two-figure number is computational because it goes beyond the basic facts. It is done mentally, or "in the head," not on paper.

In *Seeing Through Arithmetic 3*, the first actual computation with written numerals is column addition, taught on pages 156-159. On these pages the important idea is that a number has to be found and *remembered* until another number has been added to it. The basis for this is shown pictorially as well as in the textual explanations.

Children who have learned to add three or four one-figure numbers have made a definite start in computa-

tional arithmetic, but the main computational difficulty in addition comes when carrying is involved. In *Seeing Through Arithmetic 3*, the developmental work on understanding the number system (in particular, pages 42-49 and pages 139-147) now begins to pay generous returns. The major abilities required in the addition process can be acquired not only with understanding but also with rapidity as well. The addition of two-figure numbers with and without carrying is taught on pages 160-163, and the extension to three-figure numbers is made immediately on pages 164-169. With the completion of these lessons, all of the ideas essential for an understanding of addition have been introduced.

As was pointed out in the Guiding Principles (page 8), it has been customary to delay addition of two-figure numbers with carrying for weeks or even months after addition without carrying has been taught. As a result, children were unable to understand the nature of the task as a whole. The pupil could not see why he was told to begin adding with the "ones," since he could get the right answers just as easily by working with the "tens" first. He could do the examples either way, and he formed habits which later caused confusion and had to be changed. In *Seeing Through Arithmetic 3* the major difficulty is faced at the outset. This is in accordance with the principle of introducing a major concept as a whole rather than in parts. When the child learns to cope with carrying, he does not need much help and extensive practice on addition without carrying. Moreover, with this instructional pattern, the teacher does not need to be constantly on guard against giving examples that require carrying before the pupils have been taught how to do it. In the long run, this organization of learning experiences simplifies the task for both teacher and pupil.

An easy application to adding amounts of money completes the new material in this block of work.

153-155 Learning how

Lesson Briefs for this lesson are on pages 127-129.

Overview

The work on these three pages is a preparation for the lesson on column addition which pupils will encounter on pages 156-159. This preliminary work is needed because column addition of one-figure numbers requires the child to add a one-figure number that he sees in the column to a two-figure number which he has retained in his memory. In many cases the sum resulting from the new addition will be in the decade above the two-figure addend. For example, if the figures 8 plus 8 plus 9 are presented to the child to add, his first total, 16, is the sum he has to keep in mind while mentally adding 9 to it. The only figures he would actually write would be the final answer, or 25. The main purpose of pages 153-155 is to accustom the children to adding combinations of this type mentally with ease.

With the experience the children have already had in regrouping within the number system (pages 144-145), they should be able to achieve the addition of a one-figure number to a two-figure number without recourse to pencil and paper. It is assumed that by this time *all* the addition basic facts will be known by the child. Until he has these facts well in hand, no child is ready to compute or to perform the sort of mental addition presented in this treatment. If a child appears to be floundering and unable to grasp this lesson, the difficulty may lie in his lack of mastery of addition basic facts.

In teaching this lesson, the most important thing to bring out is that a new group of 10 may be formed when a one-figure number is added to a two-figure number. Pictures and text stress this idea.

Be sure to read the discussion concerning the "four-step method" in the Lesson Briefs, page 127. This lesson presents the first use of this method.

Teaching the whole class

You can begin this lesson by encouraging the children to tell about experiences they have had in the country or on "nature walks." Ask them if they have ever gathered anything while on such walks. If no one mentions acorns, you might describe how, in the woods, the ground is often strewn with acorns.

Page 153: Draw attention to Picture A and have the children read the problem. Be sure they understand that they are not expected to answer the question yet. Let them identify in the picture the acorns Dick had and the acorns Jack gave him. Be sure they understand that the ring is used to identify a group of 10. Call on someone to explain what each part of the equation means. Direct the children to read the text with the arrow for each picture and examine the picture. Then have them read the text that does not have an arrow and explain how it relates to the picture.

When they have read the first equation opposite Picture D, ask someone what number 2 tens and 5 ones is. Let another pupil read the second equation and the concluding statement. Be sure to point out to the children that when they added 9 to 16, they went from a "teen" number to the twenties—to the next group of ten.

Page 154: You may want to ask pupils if they have ever made collections of stones and let them talk about their collections before drawing their attention to the problem opposite Picture A. Let one child identify Ann's stones in the picture and another child identify Mary's stones. Then let the class decide how they know that the equation is correct.

Next ask pupils to read the questions opposite Picture B and use the picture to find the answers. Have the children look at Picture C. Let them read the first question. Choose someone to point out the new group of 10 stones. Have another child answer the second question.

Let someone explain the statements opposite Picture D, using the picture to get the numbers to insert where the screens are. Ask another pupil if he went to the next ten in adding 5 to 38.

Page 155: Let someone read Problem A aloud. You might then ask:

Do you think your answer will be in the next ten? Why? How many ones do you think you will have in your answer? What number is 3 tens 1 one?

Slow learners may need to verify this answer by working with objects to find out that 7 added to 24 actually does equal 31.

Treat Problem B in the same way. Make certain the children see that in adding 3 to 15 they do *not* go to the next ten, but stay in the teens. Point out that in adding a one-figure number to a two-figure number, their answer will be either in the same ten or in the next ten.

Let the children work Exercises C to G on their own. Suggest that they cover the part at the right of the equals sign, say the answer, then verify the answer by looking at the book.

In the DO step no help is provided in getting the answers. Let the children take turns in responding orally to these exercises. If a pupil cannot get an answer quickly, let him come to the center table or desk and work with objects until he does get the answer. After the two sets of exercises, A to X and A to V, have been done orally, have all the children copy the letters and write each answer after its letter. They should write *only* the final sum.

Providing for the able pupil

Let each of these students make up a set of about 10 examples involving the adding of one-figure numbers to two-figure numbers. Then ask them to work with the pupils who need more concrete experiences by giving their examples to these pupils to solve by working with objects. Suggest that they supervise the work to make sure the children solve each example correctly.

Helping the slow learner

Let these children pair up with the more able learners, and work out with objects the examples the abler learners prepared. See the suggestions above.

156-159 Learning how; Keeping skillful

Lesson Briefs for these lessons are on pages 129-132.

Overview

In the preceding lesson, the children began to acquire skill in mentally adding a one-figure number to a two-figure number. They will use this skill now in the addition of three and four one-figure numbers. In the problem illustrated on page 156, the sum of the first two numbers produces a two-figure number which must be remembered while the third number is being added to it.

In the following problem (page 157), involving the addition of four one-figure numbers, it is not until the third number has been added to the sum of the first two numbers that a two-figure number is reached. Then the child must again retain mentally a two-figure number until the fourth number has been added to it. In both problems the "number of tens" reached in the final answer is the next ten beyond that of the mentally retained two-figure number.

This change of tens will not always occur in subsequent problems. However, the children should be aware that it is likely to occur, and they should be on the alert to discover whether their answer should or should not reflect such a change.

Teaching the whole class

Page 156: Have the children look over the page. You may want to let the boys describe their own toy cars and tell how many they have. Then call attention to the text opposite Picture A. Let someone read the problem aloud, and then ask another pupil to point out from the three groups of cars in the picture the particular group of cars that belongs to each boy mentioned in the text. Let the pupil tell how he could use the numbers these groups of cars represent to find the answer to the problem. Ask the class if the correct equation has been made at the right of the picture, and let a pupil read this equation aloud, together with the statement after the screen. You might next say something like this:

Let's review what we do first to solve this problem. Compare the sentence opposite Picture B with what you see in the picture. Notice that the cars we are paying attention to now are pictured in strong color, while the cars we do not want to think about are dimmed off. Now look at the computation at

the right. You see that the numbers we used in the equation have been rewritten in a column. The two numbers printed in black represent the two groups of cars at the top of Picture B. How can you use these numbers to do what the picture shows?

Stress the fact that the sum of the first two numbers must be remembered until the next number has been added to it. In calling attention to Picture C, ask the class to observe the top group carefully and ask them how it became so large. Then have them tell how many of these cars are inside the ring, how many of them are just outside the ring, and how many cars are in this group altogether. Have someone read the text and relate it to the action shown in the picture and to the column of figures. (You may need to explain that the 6 and the 8 are not printed in black because we are not thinking about these numbers now, and that the number 14 is not shown because it is remembered "in the head" of the person doing the addition.) Ask the class if they think the answer to 14+7 will be in the next ten.

In discussing Picture D, you can call attention to the tens by asking how many groups of ten are in the picture and how many extra ones there are. Before directing attention to the text, you could then ask:

Two tens and 1 one are how many?

Remind the children of their previous decision [that the answer would be in the next ten, that is, in the twenties] and ask how many ones they get when they add 7 to 14. Have them look at the book to see where to write the answer. Ask if the 2 is in tens' place and the 1 in ones' place. Then let someone read the three sentences beside the arrow. Call attention to the word *sum,* and explain that the answer to a problem in addition is called the "sum." Let the class read the problem again, and call on someone to answer the question. Compare the equation at the bottom of the page with the original equation opposite Picture A above.

Page 157: Before beginning this lesson, you might let the girls describe their dolls and tell how many they have. Then have everyone read the problem. Point out that this time four groups are being combined. The method of teaching used for the preceding page may be adapted for this problem. (Note that in the THINK step the text contains questions instead of explanations.)

Page 158: In the preceding SEE and THINK steps, you have been working closely with the class. In the following steps (TRY and DO), once you have explained the method of procedure, the able pupils should be allowed to work through them without further assistance. Such pupils should, on completing their work on the TRY step, begin at once on the DO step and follow it through, ending with Exercise R on page 159. Since they will finish their work far in advance of pupils who require special attention, you will need to provide some extra activity for them. (A suggestion is given in "Providing for the able pupil" on page 285 and below.)

When introducing the TRY step, tell the children that the answers to the problems and examples are given in the computation beside them, but that they should not look at these answers until they have tried to solve each problem and example by themselves. Instruct the children to read each problem, think what equation should be made, and then check what they thought by looking at the printed equation. You might also tell them that as long as they get all the right numbers in the equation, the *order* in which they appear is not important. Explain that any pupil may proceed immediately to the DO step at any stage of his work on the TRY step when he understands the work. Be ready to help the slow learners. You can check the thinking of the less able child by having him do the work orally. If he still has difficulty, let him use objects to work out the solutions.

Page 159: The procedures just outlined should be continued for the balance of the DO step on this page. Children who need more practice may be assigned the second block of exercises (A to F).

Treat the "Keeping skillful" exercises as a separate activity. Tell children to write the figures in Exercises A to R in computational form, then add. For Exercises A to T, tell the children to write only the answers beside the appropriate letters.

Providing for the able pupil

Tell the better students to try a new way of adding the numbers in Exercises A to R ("Keeping skillful," page 159). Tell them to add the numbers across, without copying them in computational form. They should write only the answers on their papers.

Helping the slow learner

Assign Exercises A to F in the DO step, page 159, as extra work for those who seem to need more practice. If possible, have enough objects available so that the children solving these exercises may work out solutions with them.

The game of Target Toss can be used to furnish practice on column addition of one-figure numbers. See Activity 38, page 330, for complete details on making the board and playing the game. Limit the numbers on the cards to one-figure numbers.

The game of Number Bowling (see Activity 13, page 319) can be adapted to give practice in column addition of one-figure numbers. To do this instruct children to keep a record on the chalkboard of the

number of tenpins they knock down in three successive tries. Have them add their scores. The one with the most points wins.

The Cork Drop game (Activity 40, page 331) may also be used. Limit the numbers on the corks to one-figure numbers.

160-163 Learning how

Lesson Briefs for this lesson are on pages 132-134.

Overview

When children understand the number system, they can approach carrying in addition with confidence. For this reason, a brief review of the regrouping that is involved (see pages 144-145) might be the best way to begin this lesson on the addition of two-figure numbers with carrying. The four-step teaching method employed here allows the children to SEE in pictures what is happening to the numbers, to THINK why this is happening, to TRY on their own what they have learned (aided in this step by examples), and, finally, to DO problems and examples entirely unaided. Extra examples are provided in the DO step for pupils who require more practice.

Note the "dimming off" device, used on pages 160-162. The undimmed objects focus attention on the particular group the child is concerned with at the moment, and this group corresponds to the large black numerals in the text.

Teaching the whole class

Page 160: Ask if anyone has ever seen candy bars in boxes and then direct attention to the problem. When all have read it silently, call on someone to read it aloud. Then discuss the arrangement of the bars in Picture A. You might say:

Find Ann's candy bars. Now find Betty's. What equation should I write on the board for this problem? Now look at the equation in the book. Is it the same as the one on the board? How do you know that you must add to get the answer?

Let pupils discover that they must put the ones together first by reading the first sentence opposite Picture B and then following the arrow to the picture. Direct attention to the computation and to the figures in black (the ones). Ask someone to read the sentence beside the arrow pointing to the ones' column. Tell the class to add the ones and call on a pupil to tell how many ones he got when he added. Then have him read the sentence that should confirm his answer. Ask him to look back at Picture B and see if there really are 17 candy bars outside the boxes. You might say:

Are 17 ones more than 9 ones? What should be done when there are more than 9 ones?

Then direct attention to Picture C, where the children can see that 10 of the 17 candy bars are being put into a new box. Ask how many single bars there are now and let someone read the first three sentences opposite the picture. You might say:

Now let's see what we do in arithmetic. When we added 9 to 8, what did we get for an answer? We can tell that 17 is 1 ten 7 ones just by looking at the number, can't we? Read the sentence that tells where you should put the figure 7. Why is it put under the 8 and 9?

Now ask the children to read the first sentence opposite Picture D, look at the picture, and then read the next sentence. Let someone explain where the "carried" 1 came from. Be sure all the pupils understand that this small black 1 stands for the new box of 10. (Note that the word "carried" is not used in the children's textbook.)

Page 161: Ask pupils to read the first sentence opposite Picture E. Ask someone to explain how the picture shows what the sentence says. Then ask:

How many boxes of 10 are there now? Read the first sentence opposite the example. Do the adding in your head. Be sure to add the little 1 at the top. Read the next sentence. Now read the last sentence. Is it correct to put the 4 in tens' place in the answer? How many tens and how many ones are in the answer?

Then direct attention to Picture F. Have the pupils read the sentence and the equation. Ask:

Are 4 tens and 7 ones 47? Do you see 4 tens and 7 ones in the picture? Do you also see 47 candy bars in the picture?

If you wish, you may provide objects and let the slow learners use them to work through the solution of this problem. They should follow the steps shown in Pictures A to F.

The new problem in the THINK step may be treated in much the same way. The questions are designed to guide the children's thinking toward the solution. They should be able to answer the questions by examining the accompanying illustrations and applying what was done in the pictures to the figures in the example.

The lesson continues on the following page.

Page 162: In finishing the discussion of the problem begun on the preceding page, make sure the children understand each part of the process illustrated in Pictures A to F, so that when you go on to the TRY step on page 163 the class will be prepared to work with little or no assistance from you.

Page 163: Tell the children that you expect them to do all the work in the TRY step by themselves. Instruct them to read the problem, write its equation

on their papers, and then rewrite the equation in computational form, add, and write the answer in its proper place. Explain that although they may have *three* two-figure numbers to add, the method of adding will be exactly the same as in the problem they have just finished. Explain, too, that they may check their work by comparing it with the printed examples in the book. Slow learners may still need some assistance. Those who appear to be making satisfactory progress should be told to proceed with the DO step as soon as they feel ready for it.

For the DO step, children are to write the computation and answers for the first block of exercises (A to V). Tell them to label the work for each exercise with the letter the exercise has in the book. When this assignment has been completed, provide answers and let the children verify their work.

Exercises A to J in the second block may be assigned to those children who require additional practice.

Providing for the able pupil

Able learners might enjoy playing or supervising the game of Target Toss (see Activity 38, page 330).

Helping the slow learner

The game of Target Toss (see Activity 38, page 330) may be used to give practice in adding two-figure numbers.

Children may also work with small objects and three boxes, each capable of holding ten of these objects, to practice the addition of two-figure numbers. See Activity 39, page 331.

The game of Cork Drop may be used to give practice in adding two-figure numbers. Limit the numbers on the corks to two-figure numbers. See Activity 40, page 331, for directions.

164-169 Learning how

Lesson Briefs for this lesson ore on poges 135-138.

Overview

Children who have satisfactorily completed the work in the addition of two-figure numbers with carrying should have no difficulty in learning how to add numbers with three figures. In this lesson on the addition of three-figure numbers, the only new thing the children will encounter is the necessity of carrying twice in the same example.

The positions in a numeral that indicate thousands and hundreds should be familiar to children through their work on the number system. They have also had an introduction to "hundreds" in computation, since the TRY and DO steps of the previous lesson contained some examples requiring three-place answers. The problems in the SEE and THINK steps on pages 164-168 require children to consider the hundreds' column when they compute, and some problems which require answers in the thousands' column are introduced in the TRY and DO steps on page 169. For this reason, you may find it helpful to review briefly the process of grouping hundreds as thousands (pages 144-145). You might also ask questions such as:

11 tens are how many hundreds and how many tens? 17 tens are how many hundreds and how many tens? 10 hundreds are how many thousands? 18 hundreds are how many thousands and how many hundreds?

The four-step teaching method should be handled as it was on pages 160-163.

The regular assignment in the DO step is the first block of exercises (A to P). The second block of exercises (A to G) is intended for pupils who need additional practice.

Teaching the whole class

Page 164: Ask the children to read the problem on page 164 and then find the 235 candle holders and the 189 candle holders in Picture A. Procedures suggested in the Expanded Notes for page 160 may be adapted for the remainder of this page. Be sure the children relate the black numerals in the computation to the undimmed portions of the pictures.

Page 165: Continue working on the SEE step, adapting procedures suggested for Picture D, page 160, and Picture E, page 161.

Page 166: Call on a pupil to read the first sentence opposite Picture G. Tell the class to study the picture and find the pile of 100 candle holders that is shown in strong color. Try to get the children to see for themselves that this pile is in strong color because it is the pile that is being worked with—the pile that is being put with the other candle holders. You may want to ask:

When we compute, what should we do with the new 100? Can you find what has been done in the example in the book? What does it say at the right of the example?

Direct attention to the first sentence opposite Picture H and ask what the picture shows. Remind the class that the sum of the figures in the hundreds' column will show the same result as putting the piles of boxes together. Call attention to the hundreds' column and ask someone to read the sentence with the arrow. Ask the class to do what this sentence tells them to do, and then have them read the next sentence. Let someone explain why there are 4 hundreds and not 3 hundreds.

Now you might next ask:

What does the sentence beside Picture I say?

Let a pupil read the equation, and then call for volunteers to explain what each figure stands for in the numeral 424.

Page 167: Let the children read the problem and then find in Picture A the two groups mentioned in the problem. Call on pupils in turn to answer all the questions on this page. They should be able to find any answers they do not know by looking at the pictures. Pay special attention to the zero in the ones' column.

Page 168: Continue calling on pupils to answer the questions in the THINK step. Be sure to relate the computation to the pictures.

Page 169: Before giving the class free rein to put their knowledge to use in the TRY step, some discussion of Problem B may be helpful, since this is the first time a four-figure answer is to be obtained. Then let children proceed at their own rate of speed, working as they did in the TRY step on page 163. Tell them they may begin the DO step as soon as they feel able to work entirely on their own, and assign only the first block of exercises (A to P) in the DO step. The second block may be assigned to those who need more practice. Provide answers so that each pupil can verify his own work.

Providing for the able pupil

Able pupils may like to play the game of Target Toss (Activity 38, page 330) and supervise it when playing with the slow learners. See below for a description of the game as played with three-figure numbers.

Helping the slow learner

The game of Target Toss (see Activity 38, page 330) may be used to give practice in adding three-figure numbers. Put three-figure numbers on the cards and have the children keep track of the numbers of the hooks that are ringed by writing the numbers on the chalkboard. Adding up the totals of two throws will give practice in adding three-figure numbers. The child with the highest total wins. You also might use a mixture of two-figure and three-figure numbers to provide variety.

Small objects and boxes representing hundreds and tens may also be used for demonstrating the addition of three-figure numbers. See Activity 39, page 331, for directions.

170-172 Learning how

Lesson Briefs for this lesson are on pages 138-140.

Overview

In this lesson children learn how to add amounts of money in columns, using dollar signs and points. No new knowledge is required, but increased skill in addition is developed. The four-step teaching method is again employed. The second block of exercises (A to K) in the DO step is provided for pupils who require practice beyond the regular assignment.

Teaching the whole class

Page 170: This page shows children how to add amounts of money totaling less than one dollar, and how to use the point and dollar sign. You might introduce the work by asking pupils if they have ever earned any money, and by encouraging them to tell what they did to earn it. Inquire whether anyone has had more than one experience in earning money, and ask those who have had such experience if they ever tried to keep a record of the money they earned, the amount they spent, and the amount they saved. Let all the pupils join in discussing how they could keep a record of money they might earn or be given.

Next have everyone read the statement at the top of page 170, and then direct attention to the problem. Let the children look next at Picture A and count the money in the top part of the picture. Get the children to identify this money as the amount Mary had at first. Then let them count the other group of coins and discover how it relates to the problem. Call attention to the equation and let a pupil tell the class why the plus sign is used here. Remind the children of the method they used before when adding numbers with two figures in them, and direct attention to the example below the equation. You might continue as follows:

What does the first sentence opposite the example say? Add the numbers and compare your answer with the one in the book. How many got the same answer? What does the next sentence say? What does the last sentence say? Why does the answer, 81, really mean 81¢?

You might now let a pupil write 81¢ on the board. Ask the class if there is another way to write this same amount of money. Try to elicit the form \$.81. Explain that we usually use this form when adding sums of money.

Then have pupils read the sentence opposite Picture B. They should look next at the equation and compare it with the one above. They then should examine the computation with dollar signs and points. Let someone read the first sentence opposite the computation. Ask everyone to do the addition, and then call on a pupil to read the sentence with the arrow pointing to the answer. Let another pupil read the last sentence and equation and then count the money shown at the left.

The dramatization of this problem, suggested for slow learners on page 290, is an activity all the children may enjoy, if time permits.

Page 171: In this step, amounts of money totaling more than one dollar are added. Tell the children that they will compute exactly as they did on pages 164-169. Let the class read the problem and relate it to the information provided by Picture A. Discuss the equation and the position of the dollar signs and points. In calling attention to the example, you might ask: "How many cents is $1.85?" (If pupils are slow in answering, ask them to think how many cents one dollar is worth.)

Let everyone add the figures in the example and have a pupil read aloud all the statements about the example, filling in the screens in the last statement. If he runs into trouble here, ask him how many cents equal a dollar, how many cents equal two dollars, and, finally, how many dollars and cents 264 cents equal.

Let children take turns reading and answering the questions opposite Picture B. They may verify the final question by counting the money in Picture B.

Page 172: Children should work as independently as they are able to in the TRY step, verifying their work by comparing it with the examples in the book. Let everyone work at his own pace, proceeding to the DO step as soon as he feels confident of handling Exercises A to U entirely unaided. Before pupils begin their work on the DO step, call their attention to Examples B to E in the TRY step. Explain that it is not necessary to write the dollar sign except for the first amount and the answer, but that the point must always appear. Pupils who need extra practice may be assigned Exercises A to K in the DO step.

Providing for the able pupil

These children may like to keep a record of money brought for lunches, activity tickets, etc., and find the total after a period of a week or a month.

Helping the slow learner

The activity Cafeteria Line will provide children with practice in addition of money. From cards on which foods and prices are listed, children are to select well-balanced meals at a cost not to exceed that given on each card. For complete details, see Activity 41, pages 331-332.

Let two children act out the problem on page 170. Give them real money or let them use play money. Have each child count his coins aloud to make sure he has the right amount. Then have the child playing the mother give her coins to Mary. Have Mary count all the coins after arranging them in rows of dimes, nickels, and pennies. The total should be 81¢, the answer obtained in the computation. This type of dramatization may be used with any of the problems and examples on pages 170-172.

173 Checking up; Keeping skillful

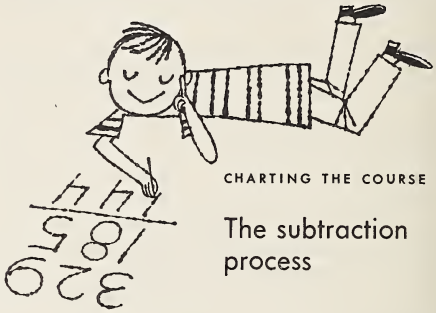
Lesson Briefs for these lessons are on pages 140-141.

Expanded Notes are not considered necessary for these lessons.

174-175 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons are on pages 141-142.

Expanded Notes are not considered necessary for these lessons.



CHARTING THE COURSE

The subtraction process

There are several different methods of accomplishing subtraction, but at the present time the "take away with borrowing" method is by far the most popular in this country. This is the method used in *Seeing Through Arithmetic 3*. When the instructional objectives emphasize understanding as well as skill in performance, the available research evidence supports the choice of this method. It is more consistent and harmonious with the guiding principles* on which the *Seeing Through Arithmetic* program is based than other methods (for example, the "additive-equal additions" method).

In addition to knowledge of the basic facts, an understanding of borrowing is necessary to learning the subtraction process. The authors are aware of the objections to the term "borrowing" expressed by some teachers and have avoided it in the pupils' book. Nevertheless, they use the term in the Teaching Guide because its meaning is well established in the minds of teachers and of the majority of parents. It can, of course, be avoided by employing phrases such as "using a ten in subtraction" or "changing 1 group of ten into 10 ones," but this is no more meaningful than "borrowing." The meaning, in any case, rests upon the operations of regrouping in the number system, and it is these that must

*See Guiding principles, pages 6-7.

be taught. The particular name or phrase used to refer to the regrouping process is a matter of minor importance if the pupil's thinking is focused on operational meaning rather than verbal expression.

The *Seeing Through Arithmetic* program builds readiness for borrowing by special learning experiences in connection with study of the number system. On pages 48-49 pupils are taught how to break up a group of 10 in a two-figure number and put it with the other "ones." On pages 146-147 this basic principle is extended to the breaking up (or "decomposition") of hundreds in three-figure numbers and of thousands in four-figure numbers. When the pupil has learned the effects of these regrouping operations on the numerals, the direct application of the ideas in borrowing is not hard to understand. As a result of this preparation, the pupil can handle subtraction with borrowing immediately instead of encountering intermediate stages of the process. He is, therefore, able to see the process meaningfully as a whole.

Pages 180-186 extend the process to three-figure numbers. Pages 187-189 apply it to subtraction when the numerals represent money. A short cut useful in the special situation in which the minuend contains zeros is explained on page 190. With the completion of these lessons, the pupil has been introduced to all of the basic ideas needed in subtraction.

A new type of problem situation is introduced on pages 193-196. Up to this time children have met the following basic types of problem situations: (1) additive, subtractive, multiplicative, and divisive (finding the number of groups); (2) comparative situations (how many more or fewer); (3) how many were added or how many more are needed; (4) partitive division (finding the size of the group). The new problem type involves finding how many there were to begin with when the number added and the resulting total are known. At the conclusion of this lesson children will have met all the types of problem situations introduced in *Seeing Through Arithmetic 3*.

176-179 Learning how

Lesson Briefs for this lesson are on pages 143-145.

Overview

In the lesson on pages 176-179 the children learn how to subtract two-figure numbers. On pages 176-177, the SEE step of the four-step teaching method is presented. Notice that the example involves subtraction with borrowing. On pages 177-178 an example is given of subtraction from a two-figure number ending in zero; this is the THINK step. On page 179 the TRY and DO steps are presented. In the TRY step the children are to work the examples and then compare their results with those given in the book. The children should work independently on the problems and exercises in the DO step. The last block of exercises should be given to those children who need extra practice.

Teaching the whole class

Page 176: Ask the pupils if they ever trade things with one another. Let them describe briefly the various kinds of trading currently popular. Then ask pupils to turn to page 176, where they will find a problem about trading cards.

Call on someone to read the problem aloud. Ask another pupil how many tens and how many ones there are in Picture A. Tell him to point to the 5 tens and the 3 ones. Then ask someone if the equation at the right describes the problem.

Ask next how many cards are to be taken away from the 53 cards. Remind pupils that when they combined objects that were in groups of tens and ones, they combined the ones first. Have them observe that in subtracting they should take away the ones first. Tell them to look at Picture A again. Ask how it is possible to take away 6 cards when there are only 3 single cards. The children should remember about breaking up a group of objects that are in a group of 10 into 10 ones. Then ask someone to read the statement opposite Picture B. Tell pupils to look at the picture, where they will see one of the packs of 10 cards being opened and being put with the 3 cards. Next ask them to look at the computational form. Have them note how the figures have been written. Draw attention to the figures they are thinking about, which are in black. Ask someone to read aloud the statements at the right of the computational form.

Call on a pupil to read the sentence opposite Picture C. Have someone point out the 4 piles of 10 cards and the 13 single cards in the picture. Then ask the class to look at the computational form to see how this is shown in figures. Point out that the lines drawn through the 5 and 3 show that these figures have been changed into new figures. Have pupils note where the new figures have been written. Ask why there are now only 4 tens. Ask how we get 13 ones. Then have someone read the sentence opposite the arrow pointing to the new figure.

Ask next if we can now take away 6 cards. Tell pupils to look at Picture D to see this happening. Now turn attention to the computational form so that pu-

pils can find out how this is symbolized. Draw attention to the sentences opposite the example. Let the class discuss the computation and the writing of the 7 in the answer.

Page 177: Direct the class to read silently the first sentence opposite Picture E. Help them relate it to the picture. Next have them read the sentences at the right of the computational form. Help them relate the computation to what is happening in the picture.

Call on a pupil to read the sentence and equation opposite Picture F. Ask someone to explain what the picture shows.

Next ask pupils to read silently the new problem presented in the THINK step and to find the 60 crayons. Have someone read the equation and tell what each number in it means and why the minus sign is used. Follow the same procedures that were used with the first problem, calling on pupils to answer the questions. Note that, even though there are no ones in the total group to begin with, the situation does not differ from that in the other problem. Here also one of the tens of the total group is changed to ones before the ones can be subtracted.

Page 178: Adapt the procedures used with page 176 to this page. Call on various pupils to answer the questions concerning what is happening to the pictured objects and the corresponding work in the computational form. Be sure the children realize that, once one of the tens has been thought of as 10 ones, the ones are subtracted in the usual way, even though there were no ones in the total group to begin with.

Page 179: Have pupils read Problem A and try to solve it themselves on paper. Tell them to compare their work with the completed example in the book. Help any of the children who have trouble. Permit those children who are not able to remember the changed figures when they borrow to write them down. Do not insist that they remember them without writing them.

Then let pupils work Examples B to E at their own rate of speed. They should compare the work and answer for each exercise with that in the book as they finish it. Discuss Example B afterward, pointing out that they do not have to change tens to ones because they can subtract immediately without changing.

Tell those pupils who had no trouble doing Examples A to E that they may go directly to the DO step and try Exercises A to T on their own. Work with the children who are having trouble doing Examples A to E of the TRY step. When these children have finished, have them proceed to the DO step.

Exercises A to P in the last block may be assigned as extra work for those who need it.

Providing for the able pupil

Able learners might like to try an activity called "Magic Squares." In this activity they must add numbers in rows on a card, determining missing numbers, which when found will make each row add up to the same total. See Activity 42, page 332, for complete details.

Helping the slow learner

Activity 39 (page 331) may be used for demonstrating the action involved in subtracting two-figure numbers. Write an example on the board, like $46-23=$▒. Have the children put 4 sticks, representing tens, in the tens' box and 6 sticks in the ones' box. Then have them remove 3 sticks from the ones' box and 2 sticks from the tens' box. The number of tens and ones represented by the sticks that remain in the boxes give the answer. The next example should be more complicated, such as $46-27=$▒. The children will see that there must be more objects in the ones' box before 7 sticks can be taken away. Remind them that they can exchange 1 ten for 10 ones by removing 1 stick from the tens' box, putting it aside in the general supply in the box lid, and picking up 10 sticks in exchange and putting them in the ones' box. This makes a new total of 16 in the ones' box, from which 7 sticks may be removed.

180-186 Learning how

Lesson Briefs for this lesson are on pages 145-149.

Overview

On pages 180-186, the children learn to subtract three-figure numbers. In the SEE step on pages 180-182 they are shown how to subtract three-figure numbers with borrowing in both tens' place and hundreds' place. The example in the THINK step on pages 183-185 shows the children how to proceed when there are no tens in the total group. It is then necessary to borrow from the hundreds before they can borrow from the tens, which they must do before they can subtract the ones. On page 186 the usual procedure of having the children work the examples in the TRY step and compare their answers with those in the book should be followed. The children should work independently on Exercises A to Z. Exercises A to L in the last block are provided for those children who need extra practice.

Teaching the whole class

Page 180: To start this lesson, show the children a full box of chalk and let them estimate the number of pieces of chalk in the box. Ask them if they have any idea of the number of pieces of chalk they use in one month. If possible, give them some idea of this number.

Ask a pupil to read Problem A, omitting the equation. Tell each child to look at Picture A and find the hundreds, the tens, and the ones. Then ask a pupil to explain the equation for the problem. Procedures suggested in the Expanded Notes for page 176 (Pictures A to C) may be adapted for the remainder of this page.

Page 181: Ask pupils what is happening in Picture D. Then tell them to look at the computational form at the right to see how the subtraction is done with figures. Get pupils to notice that this subtraction is exactly like what they did in subtracting two-figure numbers. Point out that when figures are subtracted in the ones' column, the result should be placed under these figures in ones' place in the answer.

Ask how many bundles of 10 are to be removed and how many are to be subtracted. Ask why 8 bundles of ten cannot be removed. Get them to see also that 8 tens cannot be subtracted. Ask for a suggestion as to what might be done. Have them look at Picture F. Ask someone to explain what is being done in the picture. Tell the children to look at the computational form. Say:

We have subtracted the ones. Can we subtract 8 from 1 in the tens' column? John, read the sentences opposite the arrow pointing to the tens' column.

Have pupils examine the new arrangement of chalk in Picture F and relate it to the 2 and 11 in the example. Point out that the small 2 above the crossed-out 3 shows that now there are only 2 hundreds. Point out also that the small 1 above the tens' column has been crossed out and the figure 11 has been written above it. This shows that now there are 11 tens. Then tell pupils to look at the next page to see how the tens and hundreds are subtracted.

Page 182: Have everyone look at Picture G to see the 8 bundles of ten being taken away. Direct attention to the computational form and relate the subtraction of 8 tens from 11 tens to the action shown in Picture G. Have someone explain why the 3 is put in tens' place. Then tell pupils to look at the hundreds' column. Ask if the hundreds can now be subtracted.

Let a pupil explain what is being done in Picture H. Then have the children look at the computational form and explain how it relates to the picture.

Ask a pupil to read the sentence and equation opposite Picture I. Let him explain what the 1, 3, and 8 in the answer stand for.

Page 183: Handle the work for the problem, its picture, and the equation in the way you did for Problem A on page 180.

After children have decided they should subtract the ones first, ask:

Can we subtract 6 from 5? There are no tens to change into ones. Have you any suggestions about what we might do? We must have some tens before we can change a ten into ones.

Then tell pupils to read the text opposite Picture B. Discuss why the picture shows one of the hundreds being changed to 10 tens. Next have someone explain why the same difficulty exists in the computation. Tell the children to examine Picture C and to be ready to explain, in terms of the picture, what the small black numerals represent. Tell pupils to go on to the next page.

Page 184: Get the pupils to explain why a bundle of 10 candy sticks is being opened in Picture D. Discuss how this will help the situation shown by the black numerals in the computation.

When discussing Picture E and its text, be sure the pupils understand the regrouping indicated by the small black numerals in the picture. Make clear that the picture and the small numerals still show the total quantity represented by 205.

Draw attention to the black numerals in the computation and relate them to the action in Picture F. Tell the children that when they read the text for this picture, they can find the missing numbers by examining the picture and the black numerals in the computation.

Page 185: Discuss each picture and its text separately. Keep the children aware that each picture illustrates the action called for by the black numerals in the computation for that picture. For each block of text have the children find the missing numerals by examining the picture and the computation under discussion.

Page 186: Procedures suggested for page 179 may be adapted for this page. Remember that some of the abler pupils may be able to go directly from Problem A in the TRY step to the exercises in the DO step. They should be allowed to do so. Exercises A to L in the last block are for pupils who need extra practice.

Providing for the able pupil

Magic Squares, described in Activity 42, page 332, may be adapted as an exercise on subtraction of three-figure numbers for those children who easily finish the problems and exercises in the DO step. You will need to make a new Magic Square, in which the total of all rows both up and down is the same three-figure number.

Helping the slow learner

Activity 39 (page 331) may be used for demonstrating the action involved in subtracting three-figure

numbers. Write an example on the board, like 246−123=▒. Have the children put 2 sticks, representing hundreds, in the hundreds' box; 4 sticks, representing tens, in the tens' box; and 6 sticks in the ones' box. Then have them remove from the appropriate boxes 3 ones, 2 tens, and 1 hundred. The number of hundreds, tens, and ones represented by the remaining sticks in the boxes gives the answer. The next example should be more complicated, such as 246−127=▒. The children will see that there must be more sticks in the ones' box before 7 sticks can be taken away. Remind them that they can exchange 1 ten for 10 ones by removing 1 stick from the tens' box, putting it aside in the general supply in the box lid, and picking up 10 sticks in exchange and putting them in the ones' box. This makes a new total of 16 in the ones' box, from which 7 sticks may be removed. In the case of an example in which it is necessary to have more tens in the tens' box, the same kind of exchange is made by removing 1 stick from the hundreds' box, exchanging it for 10 sticks in the general supply, and putting the 10 sticks in the tens' box.

187-189 Learning how

Lesson Briefs for this lesson are on pages 149-151.

Overview

In the lesson on pages 187-189 the children learn to subtract numbers that represent amounts of money. In the SEE step on page 187 the amounts of money involved are less than one dollar (comparable to subtraction of two-figure numbers). On page 188 in the THINK step, the amounts of money involved are more than one dollar but less than ten dollars (comparable to subtraction of three-figure numbers). The TRY and DO steps appear on page 189, and the children are given practice in the subtraction of amounts of money both less than and more than one dollar.

Teaching the whole class

Page 187: To get the children talking about money, ask them if they have recently had an opportunity to buy birthday gifts for anyone. Ask them how much they had to pay for the gifts, and whether they paid for them out of their own money or money their parents gave them. Then direct attention to page 187. In the problem on this page, the children are subtracting numbers that represent amounts of money that are less than one dollar.

First have a pupil read the problem opposite Picture A. Then have someone explain how the picture describes what is happening in the problem. Have someone explain why the equation is correct. Tell the children that the computational form shows that numbers that stand for amounts of money are subtracted in the same way as the numbers they have just studied.

Now tell the pupils that numbers that stand for money are usually written in a different way. Have someone read the sentence opposite Picture B, and have him compare the equation with the one given at the top of the page. Have someone read the sentences opposite the computational form and compare this form with the computational form above.

You may want to have the children work out this problem using real or play money.

Page 188: The problem in the THINK step involves subtracting numbers that represent amounts of money that are greater than one dollar. Adapt the procedures described for page 187 to this page, having children answer the questions and give the missing numbers that are required. Again, real or play money may be used to dramatize this problem.

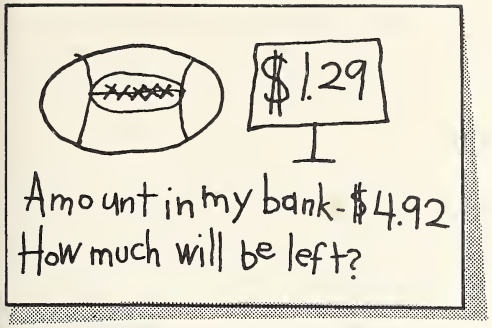
Page 189: As with other pages of this kind, have the children work the examples in the TRY step on paper and compare their work with that shown in the book. Then have them work independently on Exercises A to Y in the DO step. Remember that the children who are able may go directly from Problem A in the TRY step to the DO step. Exercises A to M are for those children who need extra practice.

Providing for the able pupil

Most children usually have two or three articles on their "most wanted" list and usually know exactly how much each item costs. Girls want paper-doll books, story-book dolls, baby dolls, etc.; boys want a flashlight, a model plane, or a football. You might let each child draw a picture of what he wants most and write the price. An "amount in my bank" might be decided upon, and this information written at the top of the picture. Below the drawing the children should write, "How much will be left?" When the pictures are completed, the children might exchange drawings and work out the solution to the problem of how much will be left when the cost of the item is subtracted from the amount in the bank. On the next page is a picture that suggests what may be drawn by the children.

Helping the slow learner

The activity, Cafeteria Line (Activity 41, page 331) contains a suggestion that involves subtraction of money. Costs of meals children select are to be subtracted from sums of money they have to pay for them. Tell children to write on their papers the number of the card they are using, and then to write the menu with prices. They are to subtract the total cost of each meal they select from suggested amounts of money they can use to pay for the meals.



190 Checking up; Thinking straight

Lesson Briefs for these lessons are on pages 151-152.

Expanded Notes are not considered necessary for these lessons.

191 Using arithmetic

Lesson Briefs for this lesson are on pages 152-153.

Expanded Notes are not considered necessary for this lesson.

192 Keeping skillful

Lesson Briefs for this lesson are on pages 153-154.

Expanded Notes are not considered necessary for this lesson.

193-196 Exploring problems

Lesson Briefs for this lesson are on pages 154-157.

Teaching the whole class

Page 193: Before the children turn to page 193, ask them to tell about any hobbies they have. Give several children a chance to describe theirs. Then tell them that on page 193 they will find a problem about a boy who collected records for a hobby. Tell them to open their books and look at Picture A. Then say:

Let's suppose that Tom had 21 records and for Christmas he was given 6 more records. What equation will help us find out how many he had in all then? I'll write it on the board [21+6=▭]. John, go to the board and find the answer. Now erase the screen in the equation and put the answer in place of it.

Now let's think about a new problem. [It may be wise to let the children examine pages 75 and 76 in connection with this problem.] Suppose that Tom had 18 records before Christmas. He was given some more records for Christmas, and then he had 33 records. How many records did he get for Christmas? What equation will show how to solve this problem? What number should I write first? What sign? What comes next? What should I write after the equals sign? The equation is 18+▭=33. [Write it on the board.] Do we add to solve this problem? Why not? What should we do? [subtract] Bob, go to the board and do the computation. Where should this answer be put in the equation? How many records did Tom get?

Now read Problem A in the book silently. Peggy, read it aloud to us. Is it like the last problem we did on the board? How is it different? What number don't we know? Read the sentence with the arrow pointing to the records. Look at the picture. Can we tell how many records there are? So when we start to write our equation, what must we write first? Read the sentence with the arrow pointing to the large red screen.

Call on a child to point out in Picture B the 6 records Tom's friends gave him. Ask the class what a group joining another group should make them think of. Get a child to explain why the "+" and the "6" have been used for the equation. Have the class read what is said about it.

Now have the pupils look at Picture C. Explain that this picture shows the next piece of information given in the problem. Ask how they can tell quickly that there are 33 records. [Pupils should see 3 groups of ten and 3.] Have them look at the equation to see what has been added. Have someone read aloud what is said about the number 33 and the screen. Then ask pupils why they cannot add to find the answer. Ask how this equation is different from the last one put on the board. Tell them that the work that follows will show them how to find the missing number.

Have them look at Picture D and explain that the records here are the same as those in Picture C. Tell them that the 33 will be used in computation to find the missing number.

Page 194: Start the work on this page somewhat as follows:

What does the sentence opposite Picture E ask you to do? The 6 records inside the ring in the picture might be the records Tom's friends gave him. [You may find it necessary to explain that for the present purpose any group of 6 records could be ringed. The numerical value of the group of 6 is important; the exact identity of the group is not.] What does the large red 6 stand for? Now look at Picture

F. Why do you think the 6 records should be thought of as gone? How does the picture suggest that the 6 records are gone? The number left will show how many records Tom had at first. When we imagine part of a group as gone from the whole group, what should this make us think of? [*Subtraction*]

Relate the example opposite Picture F to the picture.

The new problem opposite Picture A gives children a chance to apply what they have just learned. Have the problem read aloud. Then call on pupils to answer the questions beside the arrows that point to parts of the equation. Tell them the lesson is continued on the next page.

Page 195: Have pupils answer the questions asked about Picture B and the computation. Tell them to copy the numbers shown in the book and to find the answer. Ask a child to read the equation and the sentence beside it, supplying the missing numbers.

For the problem set that follows, work through the first two problems with the class. Then tell pupils that they are to solve the remaining problems on pages 195 and 196. They are to do three things for each problem: Write the equation that tells the story of the problem; put the numbers in computational form and compute; rewrite the equation, supplying the missing number (or write the number in the square or over the screen in the equation as it was first written).

Page 196: After everyone has finished the problems, ask different pupils to put on the board their solutions for problems that caused trouble. Allow each pupil to discuss and justify his equation and computation. The others may correct their own solutions from the work put on the board. Then ask a pupil to read aloud the statement beside the flag. Have pupils give the letters of the problems in which they found out how many things there were to begin with in the set of problems just completed.

In the "Keeping skillful" section, for the first block of Exercises A to I, ask pupils to do the computation that is necessary to get each answer. For the second block, first call on pupils to tell whether they should add or subtract to get each answer. Then have them do the necessary computation and write each answer beside its identifying letter. For the third block, have them write each exercise in computational form and subtract.

Providing for the able pupil

Cards with problems on them in which children must find how many things there were to begin with may be prepared for use as independent work. See Activity 33, page 328, for complete details.

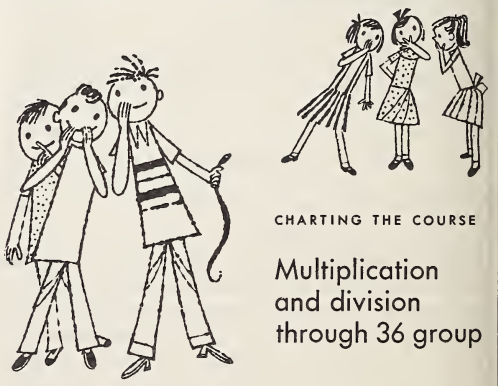
Helping the slow learner

Slower children may experience difficulty with problems in which they must find how many there were to begin with. They should be given many opportunities to dramatize such problem situations involving small quantities. Toys, such as toy autos, airplanes, blocks, etc., may be given them to work with. These children might be paired with the better pupils for this work. The slow learner should take a quantity of a certain object, without counting how many he gets. Then his partner should give him a certain number more, telling him how many he is giving. His partner should then count to find how many there are in all, and tell him this number, too. The slow learner should then perform the necessary actions with the objects to find how many he had in the beginning. Afterward he should write in equation form on the board what happened when he was given the objects. Then, by recalling what he did with the objects, he should be able to write the computational form and perform the computation.

197 Thinking straight; Keeping skillful

Lesson Briefs for these lessons are on pages 157-158.

Expanded Notes are not considered necessary for these lessons.



CHARTING THE COURSE

Multiplication and division through 36 group

In *Seeing Through Arithmetic 3* the addition basic facts are organized, for learning purposes, in terms of the sums. Thus the facts $5+1=6$, $4+2=6$, and $3+3=6$ were taught together because they belong to the 6 group. Complete familiarity with the 6 group includes knowledge of the subtraction basic facts ($6-1=5$, etc.), the multiplication basic facts ($2\times3=6$, etc.), and the division basic facts ($6\div3=2$, etc.) as well. In this pro-

gram the multiplication basic facts with products through 18, and the corresponding division basic facts, were all introduced in connection with the addition and subtraction basic facts for each group. There are no addition or subtraction basic facts for numbers larger than 18, but there are multiplication and division basic facts for numbers through 81. The multiplication basic facts that have products of 20, 21, 24, 25, 27, 28, 30, 32, 35, and 36 are introduced on pages 198-229. The corresponding division basic facts are also introduced on these pages. The remaining multiplication and division basic facts are introduced in *Seeing Through Arithmetic 4*.

The instructional methods used throughout this block of work are substantially the same as those used earlier. The only difference between these situations and those met earlier is in the size (or numerousness) of the groups. Since the groups are larger, number system ideas are used to reorganize them into groups of tens and ones, making recognition of the number of objects easy.

Division involves separating a group into equal subgroups. Strictly speaking, it is possible only with certain groups or numbers. For example, at this grade level it is impossible to divide a group of 16 objects into 5 equal subgroups. Nevertheless, with such situations it often is necessary to proceed *as though the division were possible*, and then to recognize and deal with a set of remaining ungrouped objects. Situations involving division with remainders are introduced on pages 209-210.

Mental computation, once popular in the schools, received relatively little attention for several decades. Some of it undoubtedly was done, particularly by the brighter pupils. The first step in encouraging mental computation is to make the children aware not only that such computation is possible, but also that there are various ways to find the answer to a particular problem. The alert teacher will continue to encourage mental computation in appropriate situations as they arise in the classroom. Pages 212-213 of *Seeing Through Arithmetic 3* are designed to help pupils become aware of the possibilities in mental computation.

Although the major task of pages 198-231 is to teach multiplication and division basic facts, some further applications of arithmetic in measurement situations are included. Among these are measures of time. However, the use of arithmetic in time measurement is not to be disposed of in a day. It is most appropriately learned through constant use in connection with the various activities of the school year.

198-201 Moving forward

Lesson Briefs for this lesson are on pages 158-160.

Teaching the whole class

Page 198: Let the pupils look over the page in general so they will see that the lesson concerns things they might buy at a grocery store. Ask the children whether they ever help their mothers buy groceries.

Direct one pupil to read the "Moving forward" statement. Then call attention to the first scene of Movie A. Have a child tell how many boxes are in each group and how many groups there are. Point out that the four groups are equal. Discuss what is happening in the middle scene. Help him see that the boxes that are shown in the first scene now are being regrouped into four rows of five. Explain that this new grouping shows that the four equal groups have come together. Ask what is suggested when equal groups are brought together to form a large group. Help the children recall that this action suggests multiplication.

Direct attention to the third scene. Ask:

How many rows of boxes are there and how many are there in each row? How many are there in all? Do the rings show groups of 10? Let's read the problem that belongs with Movie A. John, read the first statement below the problem and tell us how the movie shows 4 groups of 5. John, continue reading the statements, saying the missing numbers.

Have the class look at Movie B and have a pupil read the problem beside it. Ask:

What does the first scene of Movie B show us about the problem? In what way have the groups of four been rearranged in the second scene of Movie B? How many rows of four are there? What do the two scenes in Movie B suggest? [*Multiplication*] *How many boxes are there in the second picture? How do the rings help us see groups of 10?*

Ask a child to read the statements and equation under the problem and give the missing answers.

Page 199: Proceed with Movies C, D, and E in a manner similar to that outlined for Movie B on page 198.

Page 200: Proceed with Movies F, G, and H in a manner similar to the procedure suggested for Movie B, page 198.

Page 201: Teach Movie I in much the same way that you have taught preceding movies in this block of work.

Then suggest that the class look next at Exercises A to I. Point out that these are the new facts they have been studying. Have the pupils take turns reading the equations, saying the missing numbers. If they

have any difficulties, let them find the movie in the text that shows that basic fact. Then have the equation read and the missing number supplied. You may also direct the class to write the complete equations on their papers.

The pupils may take turns reading aloud Statements A to R, saying the missing numbers. Then ask them to write and complete an equation for each statement.

Ask the children to tell (or make a list of) the equal groups they have learned to put together in this lesson. Then have them read aloud the statement beside the flag.

Use the "Keeping skillful" section separately. For Exercises A to F, have the children write only the answers after the identifying letters. For Exercises A to L, ask the children to do the computation that is necessary to find the answers.

Providing for the able pupil

Let each of these pupils choose one of the multiplication basic facts for 20, 21, 24, or 25 and make up a problem that involves the basic fact he has chosen. Let each child draw a movie to represent his problem. Have him show his movie to the class to see if the other pupils can tell which multiplication basic fact has been represented.

Activity 44, page 333, may be continued. The chart should be extended through the 25 group.

Helping the slow learner

Let the pupils make a new basic fact disk that includes the multiplication basic facts for 20, 21, 24, and 25 (see Activity 31, page 326). Suggest that the pupils have a contest playing Spin-It with their new basic fact disk.

202-205 Moving forward

Lesson Briefs for this lesson are on pages 161-163.

Teaching the whole class

Page 202: Suggest that the pupils look at the page. Then have someone read the "Moving forward" statement. Call attention to the problem for Movie A and ask the pupils to read it. Ask a pupil how many bars of soap are in the first scene of Movie A. Let a pupil explain the second scene by telling how many bars of soap are in each of the ringed groups and how many groups of five there are. Bring out that the separating of a group into smaller equal groups suggests division.

Let a pupil read the statements and equation and say the missing numbers.

Use the procedure outlined above for Movie B and its text.

Page 203: Let the children look at the page and then call attention to the problem for Movie C. Ask a child to tell how many boxes of breakfast food there are in the first scene of the movie. Point out that the arrangement (2 rows of 10 boxes and 1 single box) makes it easy to tell how many boxes there are in all. Have the class look at the second scene. Get a pupil to explain that the rings around groups of 3 show that the large group of 21 is divided into smaller equal groups. Ask how many groups of 3 there are. Let a pupil read the statements and equation, supplying the missing numbers.

Proceed in a similar way with Movies D and E.

Page 204: Use the procedures outlined for Movie C on page 203 in teaching the remaining three division basic facts for 24 introduced on this page.

Page 205: Proceed with Movie I and its text in the way suggested for Movie C on page 203.

Then have the pupils take turns reading Equations A to I, saying the missing numbers. If any pupil has difficulty, let him find the fact that troubles him in one of the movies on pages 202-205. If you wish, the class may also use these exercises as written work.

Complete equations should be written for Exercises A to R. Let the children take turns reading aloud the equations they have written.

Ask the class to tell what numbers they have learned to divide in this lesson and into what equal groups these numbers can be divided. Then call on a pupil to read the statement at the end of the lesson.

Use the "Keeping skillful" section separately. Let the pupils write the answer for each equation in the first block of exercises (A to N) opposite its identifying letter. For Exercises A to G in the second block of work, remind the children that here they are to find the number in each group instead of the number of groups. Tell them that after each identifying letter they should write, first, the statement that tells what they should divide. After this statement they should rewrite the equation, supplying the missing number. For the last block of exercises (A to G), tell the children to write the numbers in computational form and find the answers.

Providing for the able pupil

Tell the abler students to make up problems using the division basic facts for the numbers 20, 21, 24, or 25. If the children wish to illustrate or dramatize their problems, let them do so. After each problem the pupil should write the complete equation for the problem.

Use may be made here also of the chart shown in Activity 44, on page 333, for division through the 25 group.

Helping the slow learner

Let the pupils make a new basic fact disk including the division basic facts learned in this block of work for their Spin-It game (see Activity 31, page 326). Suggest that the pupils have a contest playing Spin-It with their new basic fact disk.

206 Checking up; Side trip

Lesson Briefs for these lessons are on pages 163-164.

Teaching the whole class

Page 206: Give the children enough time so that they can complete each of these four tests easily, without feeling hurried. See the Expanded Notes for page 36 (Teaching Guide, page 225) for a discussion about tests. For Tests 1 and 2, tell the children to rewrite each equation, supplying the missing number. Note that these tests are on the multiplication and division basic facts with products and dividends of 20, 21, 24, and 25, which the children have just studied.

Test 3 tests the children's ability to deal with a division equation that requires them to find the size of a group. Tell the pupils that for each example they are to write a statement telling what they should do. For example, for Equation A they should write "Divide 24 by 6." Next they should rewrite the equation, supplying the missing number.

Test 4 is a mixed test in multiplication and division for the groups 20, 21, 24, and 25. Each equation should be rewritten, with the missing number supplied.

The purpose of the "Side trip" is to teach the ordinal words as a system, not as a rote exercise. Direct attention to the first column, A to O. Have a child read the numerals from 1 to 15. Then read the ordinal names for the numerals from 1 to 15 to the class (first, second, etc.). Explain that ordinal number words are used to show position or order. Suggest that the children take turns reading these words aloud until they are familiar with them. Then, as you say a numeral, have a pupil say the ordinal word for it. For example, when you say "eleven," the child should say "eleventh." Discuss the -th endings and the three exceptions (first, second, third) and the words that change their form for ordinals (fifth, ninth, twelfth).

Provide each child with several small objects (small pieces of clear plastic are good) to use as markers and say something like this:

Let's play a game with the picture of the row of chairs in your book on page 206. Notice that the chairs are numbered from left to right. How many chairs are there? What are the numbers of the chairs with stripes on them? I am going to ask you to tell where each chair is. Chair number 1 is the first chair. Where is chair number 2?

Continue until all the chairs have been identified by their position. Then go on:

Now we are ready for the game. I will say the positional word for one of the chairs, and you will put your marker on the chair that I mention. Put your marker on the sixth chair . . . the fourth . . . the ninth . . . and so on.

Continue saying the ordinal words in mixed order through fifteenth. As you say each ordinal word, watch the children's books and markers to see that they are proceeding correctly. Then say:

Now let's change our game and pretend that the markers are pupils. When I say a chair number, you put a marker or a "pupil" in the chair. But sometimes I will say the number of a chair that already has a pupil in it. When I do this, you are to say "taken" just as fast as you can, because we don't want more than one pupil in a chair.

Call out ordinals as before, except that you can say them faster. Occasionally repeat one and watch to see that the children notice it and that someone says "taken."

Now have the class consider the second column (A to O). Let the pupils take turns reading the ordinal words in this column. Ask questions that will help the children extend this list as far as time and their interest permit. Have the pupils close their books. Then ask them to open their books to the fortieth page. Do this for as many of the ordinal words as you have time for. Let each pupil take a turn selecting any page in the book and saying the ordinal word for that page. Have the rest of the class find the page that has been identified by its ordinal name. Notice that after one hundred, an ordinal is read as "one hundred fiftieth," etc., rather than as "one hundred *and* fiftieth."

Direct the children's attention to the last column of numerals and let the pupils each read one aloud, saying its ordinal name.

Providing for the able pupil

Have these pupils write the ordinal words in order from 16 to 50; from 50 to 100; from 100 to 150, etc.

Helping the slow learner

Line up ten or more chairs if they are available. If not, mark off ten or more places at the board. Then call on a pupil by name to "sit in the third" chair or to "stand in front of the third space" at the board. Continue until all the chairs or spaces at the board are filled. At this point you might call on a pupil to take the place of the child in the "third chair," etc., until all the children have had an opportunity to take a position.

For another activity, write the ordinal words on slips of paper for as many pupils as there are in the group. Let each pupil draw a slip of paper. Now have them line up in front of the board according to the positions they drew. Let each find his own place in the line. When all the pupils are in place, go down the line, letting each child say his place name (ordinal number).

As a variation, let the first child imagine he is sixtieth in line. Have the children after him in line then give the ordinal words for their positions.

207-208 Checking up

Lesson Briefs for this lesson ore on poges 164-166.

Expanded Notes are not considered necessary for this lesson. See the Expanded Notes for page 36 on page 225 of this Teaching Guide.

209-210 Moving forward

Lesson Briefs for this lesson are on pages 166-167.

Teaching the whole class

Page 209: Tell the children that the butterflies in the pictures on page 209 are mounted and might be found in a museum. Then ask them to read the first four lines of text. Continue with such questions and statements as these:

How many butterflies are there in Picture A? How many butterflies are in each group? Are these groups equal? How many groups of butterflies are there? Where is the sixteenth butterfly? Why is it left out? [*Bring out that if the remaining butterfly were included in any of the groups, the groups would not contain an equal number.*] *In the picture we have a group of 16 butterflies, and we want to separate or divide them into equal groups of 5. But we find that when we separate them into as many groups of 5 as possible, there is one left over. We call the one left over the remainder.*

Write the word *remainder* on the board. Tell the class that this is a new word they will find in their book today. Have the pupils look at page 209 and find this new word. They may notice that it appears several times.

Ask a pupil to read the rest of the text for Picture A and the equation.

Use a similar procedure for the problems for Pictures B, C, and D. Be sure the children use the pictures to determine the number of groups and the remainder. Work for an understanding of the fact that the remainder is always smaller than the divisor. Ask why. [If it were larger, there would be another equal group.]

Page 210: Ask a child to read the first four lines of text. Direct attention to Picture E and point out that the circled groups represent the butterflies that would be put on cards. Ask how many butterflies are in each circled group. Ask how many groups of 9 there are. Let a pupil tell how many butterflies are left over. Have a pupil cover up the text with his hand and try to state in equation form what he has learned. Let him check his equation against the one in the book.

Continue with:

You now know that when 25 is divided by 9 there is a remainder. What is the next number smaller than 25 that can be divided by 9 with no remainder? [*Help them to discover that it is 18 by trying the numbers below 25 in succession. Try to get the children to see that the division basic facts are the clue to these numbers.*] *18 divided by 9 is what? If you divide 25 butterflies into groups of 9, how many butterflies will be left over?*

Ask a pupil to read the equation in the text, saying the missing numbers.

Treat Picture F and its text in the same way.

Ask a pupil to read Problem A. Let another pupil go to the board and write the equation, using screens (or squares) for the missing numbers. When the equation has been written, ask the class to tell the next number smaller than 20 that can be divided by 6 with no remainder. If they have difficulty, let them experiment with 20 objects. Ask how many groups of 6 they can make. Let a pupil tell how many objects it takes to make 3 groups of 6. After they have seen that 18 is the next number smaller than 20 that can be divided by 6, ask how many objects are left over. Now let a pupil go to the board and fill in the missing numbers in the equation. If some child points out that 12 can also be divided by 6, help him see that if 12 is used, there will be a remainder of 8. Ask questions that will require the children to give reasons why the remainder should never be so large that another equal group could be made from it.

Have the class read Problem B and look at the equation. Have a pupil tell whether 21 can be divided by 4. Ask what the remainder will be.

Direct attention to Exercise C and ask the children in turn which of the numbers can be divided by 4. Continue in the same way with Exercise D.

Call attention to Exercises A to R. Have the pupils take turns reading the equations, saying the missing numbers. Each child should first determine the next number smaller than the dividend that can be divided by the divisor without a remainder. He then should say the number resulting from the division and the remainder. After the exercises have been gone through

orally, you may ask the pupils to write the equations and answers for Exercises A to R. If any of the children have trouble, let them use objects to see how many groups of the size called for by the divisor they can find. They can then count the remaining objects and record this number as the remainder.

Ask a pupil to tell in his own words what has been learned in this lesson; then let him read the lesson summary beside the red flag.

Providing for the able pupil

For the able pupils, you might prepare cards, each of which shows a number from 10 to 25. The cards and numbers should be large enough so that the children can see them easily. Hold up a card (the one for 13, for example) and ask if any number can be divided into it without leaving a remainder. When the pupils have determined that 13 cannot be divided by any number without leaving a remainder, ask what remainder there will be when 13 is divided by 2, 3, 4, 5, 6, 7, 8, and 9.

Activity 43, page 332, may be adapted for division with remainders through the 25 group.

Helping the slow learner

Prepare some 3 x 5 cards, each containing an example of division with a remainder for numbers up to 25. You may put the answers on the back for reference, but the children should try to do the division mentally. Let them use objects, if necessary.

211 Using arithmetic

Lesson Briefs for this lesson are on page 168.

Expanded Notes are not considered necessary for this lesson.

212-213 Thinking straight

Lesson Briefs for this lesson are on pages 169-170.

Expanded Notes are not considered necessary for this lesson.

214-215 Moving forward

Lesson Briefs for this lesson are on pages 171-172.

Teaching the whole class

Before the children look at page 214, show them a clock (an alarm clock will do). Show them the numbers that mark off twelve hours, the hour hand, and the minute hand. Ask one child what time he gets up on school mornings. If, for example, he should say 7 o'clock, move the hands to show 7 o'clock. Explain that they are to pretend that the time is seven in the morning. Move the hands to show 8 o'clock, 9 o'clock, 10 o'clock, and so on, until the hands again show 7 o'clock. Tell the children to imagine that the clock now shows 7 o'clock in the evening, and the hour hand has gone around once. Ask them what they do at seven. Ask what time they go to bed. Move the clock hands to show that time. Then continue to turn the hands, pointing out each hour as the hands come to it. Explain that it is still night and that most people are asleep. When the hands are at seven again, tell them to pretend that it is morning and time to get up. Point out that the hour hand has gone around the clock twice. Get the children to see that from the time a school child gets up at seven one morning to the time he would be getting up at seven the next morning, the hour hand has gone around 12 hours and then around another 12 hours, making 24 hours for a complete day and night.

Page 214: Ask the class to look at the pictures at the top of page 214. Point out that in Picture A the boy is asleep because it is the middle of the night. Explain that 12 o'clock at night is midnight. Ask what the boy is doing in the next picture. Explain that this picture also shows twelve o'clock, but now it is noon. Point out that the hour hand has gone all around the clock from 12 back to 12. Twelve hours have gone by. Say that this is half of a complete day. Explain that to get back to midnight again, the hour hand must go all around again and come back to 12 midnight. Get a child to explain what has happened to the hour hand in Picture C.

Suggest that a pupil tell what the moon and the sun in the pictures indicate. Ask a child to read each word in Pictures A, B, and C.

Direct attention to Picture D. Ask a child to tell which is the hour hand and which is the minute hand. Ask him to find the hand that measures the seconds, called a second hand. Point out the dots that mark the minutes. Ask a pupil to count the minutes marked on the clock between the figures 1 and 2. Call attention to the shaded minute hand in Picture D and say that this indicates the position of the minute hand one minute ago. Point out that the small arrow near the 2 shows the distance the minute hand has moved during the past minute. Explain that the second hand goes completely around in 60 seconds. In this time the minute hand goes from one minute mark to another minute mark and thus records 1 minute. Therefore, 60 seconds equal 1 minute. Ask a pupil to count the minutes around the clock from 12 to 12. Let another child count the minutes by fives. Explain that when the minute hand has traveled from 12 back to

12 or from any number on the clock back to the same number, it has measured 60 minutes, or one hour. Ask how many minutes there are in one hour. If necessary, remind the pupils of the number of minutes they counted from 12 to 12. Let a pupil read the statement below Picture D.

Let one child use a watch with a second hand and another child count the seconds by saying "alligator one, alligator two, alligator three," up to "alligator sixty." Have the first child report how nearly the second child counted off one minute. This can be made into a game to see who can most nearly count off a minute.

For Picture E, point out that the large circle with the arrow indicates that the minute hand has made a complete circuit of the clock from 12 to 12, measuring one hour. Then ask a pupil to tell how far on the clock the hour hand has traveled during this hour. Be sure he understands that the shaded hour hand indicates the position of the hand an hour ago (that is, at 2 o'clock). The hour hand now points to 3 o'clock. The arrow outside the clock shows how far the hour hand has traveled in an hour. Ask a child to read the statement below the picture.

Let the pupils solve the problems and questions in Exercises A to F by using the table of time equivalents. Allow them to use this table as freely as they need to when they work these exercises. For Exercise B, remind the pupils that a complete day is 24 hours. For Problem D, point out that the answer will be in terms of weeks and days, since there will be a remainder. The children will probably need to consult the calendar on page 71 when they work Exercises E and F.

Page 215: Point out that when the clock shows 3 o'clock, the time may be 3 o'clock in the afternoon or 3 o'clock in the night. Tell the children that they are going to learn how to write time to show which they mean. Call attention to Picture F. Let a pupil read the text below the clock and point out that the time could mean twelve at night or twelve in the daytime.

Have the class look at Picture G. Ask a pupil to tell what time the clock shows. Point out that the time could be either twelve-five in the afternoon or twelve-five at night. Explain that to let people know whether you are speaking of time in the morning or time in the afternoon, you use the letters A.M. and P.M. Explain that the letters A.M. stand for *Ante Meridiem,* and they mean *before noon.* Therefore, all time from midnight to noon is called A.M. All time from noon to midnight is called P.M. Explain that P.M. stands for *Post Meridiem* and means *after noon.* Ask:

If we imagine that the clock in Picture G shows five minutes after *12 o'clock noon, should it be called* A.M. *or* P.M.*? [If necessary, remind the class that at any time after 12 noon the time is* P.M.*] If the time on the clock means five minutes after midnight, would it be* A.M. *or* P.M.*?*

Point out also that for 12 o'clock we must say either 12 noon or 12 midnight, instead of using A.M. or P.M. Refer pupils back to Picture F to see these phrases in use.

Ask a child to read the text below the clock in Picture G. Have the children look at Picture H. Ask them to cover up the text below the clock with their hands. Say that the time is after midnight and have a child tell what time it is. Be sure he uses "A.M." Let another pupil tell the time if the clock shows time after twelve noon. See that he uses "P.M." Call on another child to read the text below the clock.

Direct attention to Exercises A to L. Let the pupils take turns reading the statements and supplying A.M. or P.M. for the words "morning," "night," or "afternoon." Ask a pupil to go to the board and write the time for Exercise A, using numerals and A.M. Now have all the pupils write these "times" on their papers, using numerals and the symbols A.M. or P.M. In Exercises F and H be sure that the pupils understand that although these times are at night, they are after midnight, and any time between twelve midnight and twelve noon is labeled A.M.

Let the children take turns reading the times in the last block (Exercises A to F). For each exercise they should state whether the time comes at night, in the morning, or in the afternoon.

Ask a pupil to state what he has learned in this lesson. Then let him read the statement beside the brown flag.

An activity for the whole class could be a time-telling game. If possible, bring to class one or more old clocks that are large enough for all the class to read easily. Let the children use the clocks in small groups. The children in each group may take turns setting the clock and telling whether the time is morning, afternoon, or night. The other children in the group should write the time on paper, using A.M. or P.M. As a variation, the children might like to play "Time Charades." In this game, one child sets the clock for a specific time, then acts out something that might happen at that time or that he might be doing at that time. The others guess what he is doing and then tell the time, indicating whether it is A.M. or P.M.

Providing for the able pupil

Suggest that the children look through magazines at home and find an advertisement, story, or any printed

matter that mentions a time of day. Have the children cut out the section that mentions a time of day and bring it to school. Let them mount their advertisement or text on paper. Instruct them to write the time below the clipping in two ways, first using numerals and the letters A.M. or P.M.; then in a statement, telling whether the time is morning or afternoon. Exhibit the mounted clippings.

Helping the slow learner

Let the children make Time Memorandum Lists. For a week have them make a list of happenings during the day that they need to remember, such as the following:

Get up in the morning
Arrive at school
Eat lunch
Leave school
Wash hands for dinner
Go to bed

Let the children suggest other times important to them, such as time for a music lesson, choir practice, etc., to include in the list. Ask each child to write his own list, using only items that apply to him. Make sure the children leave a space of an inch or more between their entries. Now tell the pupils to draw a circle below each entry. Have them first write in the 12, 3, 6, and 9 for a clock face and then fill in the other numerals. When all the clocks have been drawn, tell the children to draw hands on each clock to indicate the time each activity listed takes place. The children may want to use colored pencils when drawing their clocks to make the page gay and bright. Exhibit the Time Memorandum Lists.

215-216 Using arithmetic

Lesson Briefs for this lesson ore on poges 172-173.

Expanded Notes are not considered necessary for this lesson.

217 Thinking straight; Keeping skillful

Lesson Briefs for these lessons ore on poge 174.

Expanded Notes are not considered necessary for these lessons.

218-219 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 175-176.

Expanded Notes are not considered necessary for these lessons.

220-224 Moving forward

Lesson Briefs for this lesson are on poges 176-179.

Teaching the whole class

Page 220: Since the theme for this lesson is "Playing at Home," you might ask several of the children to tell what game they like to play at home. Have them tell how many children can play the game at one time, and how many objects (if any) are used.

Let the class look at the page and ask a pupil to read the statement at the top. Have another child read the first three lines of text opposite Movie A. Direct attention to the first scene, and ask a child to tell how many groups of jacks there are and how many are in each group.

Call attention to the second scene. Ask what has happened to the jacks. Ask what is suggested when equal groups join to form a larger group (multiplication). Let a pupil tell how many horizontal rows there are and how many are in each row. Get another pupil to explain why the groups of ten are circled. Ask a child to tell how many jacks there are altogether.

Ask a pupil to read the rest of the text for Movie A, saying the missing number.

Follow a similar procedure for Movie B.

Page 221: Let the pupils continue on this page with the procedure suggested for page 220.

Page 222: Continue with the procedure outlined for page 220.

Page 223: Use the procedure outlined for page 220.

Page 224: Proceed with Movies L and M in the same way you did with the preceding pages of this lesson.

Then call attention to Exercises A to M. Let the children take turns reading the equations, saying the missing numbers; then have them write the equations with answers on their papers. Work through the next block of exercises (A to Z) orally first; then assign them as written work.

Ask a child to tell all the numbers he has learned to make by multiplication in this lesson. Have another pupil read the statement at the end of the lesson.

Let the children try the "Football Game" described in Activity 43, page 332, as a class activity.

Providing for the able pupil

Follow the suggestions for the 20, 21, 24, and 25 groups made in the provisions for abler pupils on page 298.

With this lesson all the multiplication basic facts to be learned in the third grade have been presented. Some of the abler students may enjoy summarizing their knowledge by making a multiplication chart showing the multiplication basic facts as far as they

have been learned. For details in making the chart, see Activity 44, page 333.

Helping the slow learner

Follow the suggestions for the 20, 21, 24, and 25 groups made in the provisions for slow learners on page 298.

225-229 Moving forward

Lesson Briefs for this lesson are on pages 179-182.

Teaching the whole class

Page 225: Let the class look at the page in general. Since the movies on the page show bells, you might begin the lesson by asking the children what these bells could be used for.

Ask a child to read the statement at the top of the page. Have a pupil read the first four lines of text and direct attention to Movie A. Ask how many bells are shown in the first scene. Call on a pupil to tell how many bells are in each ringed group in the second scene and how many groups there are. Ask a pupil what is suggested when a large group separates into smaller equal groups (division). Call on a child to read the equations and statements below the problem, saying the missing number. Then refer back to the question in the problem. Say:

If $27 \div 9 = 3$, how many boxes *will be needed for the 27 bells?*

Use the same procedure for Movie B and its problem.

Page 226: Use a procedure similar to that suggested for page 225.

Page 227: Adapt the procedure outlined for page 225.

Page 228: Use the procedure outlined for page 225.

Page 229: For Movies L and M, follow the procedure that was suggested for the preceding basic facts in this block of work.

Let the pupils take turns reading Equations A to M, saying the missing numbers. Then ask them to write the equations with answers on their papers.

Have the children take turns reading the second block of exercises (A to Z), saying the missing numbers. You may also ask them to write the equations and answers on their papers.

As a class activity for practice on division basic facts, let the children try the "Football Game" described in Activity 43, page 332.

Providing for the able pupil

Follow the suggestions made in the provisions for abler pupils on page 298 for the 20, 21, 24, and 25 groups.

This lesson completes the division basic facts to be taught in the third grade. The abler students might enjoy making a division chart that includes all the division basic facts they have learned so far. See Activity 44, page 333, for instructions on making the chart.

Helping the slow learner

Follow the suggestions made in the provisions for slow learners on page 298 for the 20, 21, 24, and 25 groups.

230 Checking up

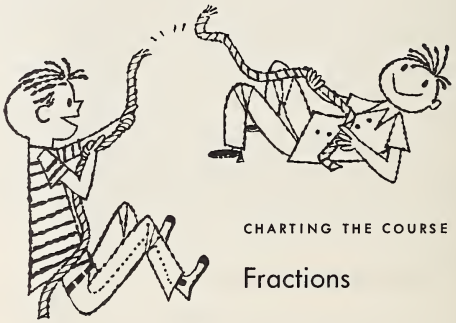
Lesson Briefs for this lesson are on pages 182-183.

Expanded Notes are not considered necessary for this lesson.

230-231 Using arithmetic

Lesson Briefs for this lesson are on pages 183-184.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Fractions

It is customary in Grade 3 (and even in the earlier grades) to help children acquire some ideas about fractions. Prior to Grade 4, however, work with fractions should be viewed by the teacher as chiefly readiness work for fractions. Pages 232-240 of *Seeing Through Arithmetic 3* provide learning experiences that develop readiness for understanding fractions.

In everyday experience, one group of objects is frequently related to another group of objects. For example, suppose a lunch box contains 4 apples and 6 sandwiches. In this simple example it is easy to see that the food can be grouped into 2 piles so that in each there will be 2 apples associated with 3 sandwiches. The general principles that underlie the regrouping in

this example illustrate "the reduction of fractions to lower terms." Whenever a fraction has been reduced to lower terms, some regrouping has been done. The common divisor in such a reduction is the number of new groups proportional to the original group that can be made. Although the major use of this regrouping occurs in connection with ratios and fractions, this regrouping can be studied without reference to fractions. When so studied, it helps provide readiness for the learning of fractions. Pages 232-235 provide learning experiences with this regrouping. They also provide readiness for changing a fraction to higher terms, as when $\frac{2}{3}$ is to be replaced by $\frac{4}{6}$.

The basic concept of fractions involves the simultaneous use of two ideas. First, an object or a group of objects is partitioned into equal parts or subgroups. For example, a cake is cut into 4 equal parts. In the fraction symbol, the denominator 4 represents the number of equal parts thus obtained. Second, a certain number (say 3) of these equal parts are selected for special attention. In the fraction symbol, the numerator 3 represents this number of parts. This involves thinking of both of the numerals together as one symbol.

The child is not expected to acquire this set of ideas all at once. With careful instruction he can, however, make a beginning in the primary grades. In *Seeing Through Arithmetic 3*, a basis for understanding fractions is given on pages 237-240.

Page 242, on geometric forms, although not an essential part of this development, serves to introduce such useful terms as circle, square, and triangle.

232-235 Moving forward

Lesson Briefs for this lesson are on pages 185-187.

Teaching the whole class

Page 232: Have pupils open their books to page 232 to see what some children made to sell at their school fair. First, have the class identify the various animals that the children made.

Then direct attention to the top scene of Movie A. Ask how many horses there are and how many giraffes. Let pupils work in groups of three or four in dramatizing the movie. See that each group of children has two different kinds of sets of 12 small objects each, one set to stand for the horses, the other for the giraffes. The objects might be two different colors of construction paper, two different kinds of clearly distinguishable objects, or two different shapes of oaktag.

Ask one child in each group to pick out 4 objects of one kind that all will pretend are the horses and 6 of the other kind that they will pretend are giraffes. Let one child in each group put the "horses" into equal groups. Let another child in each group put the "giraffes" into equal groups. (See arrangements in Scene 2 of Movie A.) Tell another child to see if he can arrange 4 horses and 6 giraffes into equal groups in a different way.

Now call on pupils to tell how many equal groups of horses they found. Ask how many are in each group. Then ask the children who worked with the giraffes to tell the number of equal groups they found and how many are in each group (3 groups of 2; 2 groups of 3). Tell the children to look at the two groupings of giraffes. Ask if they can find one arrangement that has the same *number of groups* as the horses (the 2 groups of 3). Tell them to put the other arrangement of giraffes away. Then ask how many giraffes are in each of the two groups. Then say:

We have two groups of horses and two groups of giraffes. Rearrange these groups into two sets so that each set will have one group of horses and one group of giraffes. How many horses are in each set? How many giraffes are in each set? Are the two sets alike?

Check the children's work to see that they have put 2 horses and 3 giraffes in each set.

Direct attention again to Movie A. Point out that the four scenes go downward. Get the children to see how the horses and giraffes have been arranged in groups in the second scene (2 groups of 2 for the horses; first 3 groups of 2 and then 2 groups of 3 for the giraffes). Guide the pupils to see that this scene shows the equal groups into which they separated their objects. Say:

The 4 horses have been separated into groups of how many? How many groups of 2 are there? When we separate a group into equal groups, what are we doing? Look at the first row of giraffes in the second scene. The 6 giraffes have been divided into equal groups of how many? How many groups are there? Look at the second row of giraffes in the same scene. The 6 giraffes have been divided into groups of how many? How many groups are there?

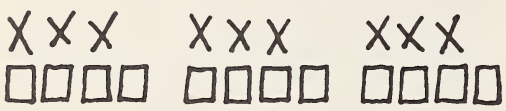
Now look at the third scene. When we worked with objects, we wanted to find the same number of groups of giraffes as groups of horses. Is the number of groups of giraffes in this scene the same as the number of groups of horses?

Look at the fourth scene. What has happened here? Are the two sets of horses and giraffes alike? [*2 horses and 3 giraffes to each set*]

Work with Movies B and C in much the same way. You may not need to use objects with these movies except when working with the slow learners.

Page 233: For Movie D, ask how many lions and how many tigers there are in the first scene. Ask into how many equal groups the 9 lions can be divided (3 of 3 each). Ask for possible arrangements of the 12 tigers into equal groups (6 of 2 each, or 4 of 3 each, or 3 of 4 each, or 2 of 6 each). Then have pupils tell the *number* of groups into which the lions have been divided in Scene 2.

Remind the children that 9 can be divided only into 3 equal groups of 3. Ask them to find and identify the row of tigers that matches the lions in number of groups. Ask how many tigers are in each of the three groups. Then let a volunteer come to the board and illustrate how the lions and tigers can be arranged in sets. Tell him to use X's for the lions and squares for the tigers. His work on the board should look like this:



Next let pupils tell how many cows and how many sheep there are in Picture E. Ask them to read the text silently to discover what to do. Direct the pupils to use objects (one kind for cows, another kind for sheep) and see into how many equal groups they can divide 6 (2 of 3 each, 3 of 2 each) and then 10 (2 of 5 each, 5 of 2 each). Have them look at their groupings to find a division into the same *number* of groups in both sets of objects (2 of 3 each for 6, and 2 of 5 each for 10). Tell them to place these groupings (2 groups of 3 cows; 2 groups of 5 sheep) beside each other and to remove the other groupings. Then have them rearrange the groupings into sets. Each set must have 3 cows and 5 sheep in it. Ask how many of these sets there are. Then call on a pupil to answer the last two questions of Exercise A.

For Picture F, have pupils first determine how many elephants and how many rocking horses there are. Then have them read the text to see what to do. Let pupils use objects (two kinds), if necessary, to find answers to the two questions. You might suggest that, instead of using objects, they think of a number that 6 can be divided by, then think if 8 can be divided by the same number. If 8 cannot be divided by that number, tell them to try another number that 6 can be divided by.

Have pupils read Exercise C silently. Then call on pupils to answer the two questions. Let someone explain what happens when 8 is divided by 2 and 10 is divided by 2. Have him use two kinds of marks on the board to show what happens when the dogs and sheep in Picture G are divided into 2 groups.

Use Questions A to E as oral work. Allow the children to use objects (of two different kinds) if they need help in answering these questions.

Page 234: Have children tell how many horses and how many zebras there are in the first scene of Movie A. Tell them that the 2 horses and 3 zebras will just fit in the box pictured. Then ask them to look at the second scene, showing a number of groups of horses and zebras. (Note that the horses are in groups of 3, 4, and 7. The zebras are in groups of 5, 6, and 9.) Explain that someone wants to buy two boxes (see Scene 3) of horses and zebras. Ask which group of horses and which group of zebras the clerk should pick out so that he can put 2 horses and 3 zebras into each box.

Have the children look at the horses in Scene 2. Say:

> *Look at the first group of horses* [*the group of 3*]. *How many are there? Are there just enough in this group so that the clerk can put 2 horses into each of 2 boxes? Look at the next group of horses* [*the group of 4*]. *Are there just enough for the 2 boxes? Look at the last group* [*7*]. *Can we use this group? Which group has just enough horses in it so that 2 horses can be put into each box?*

Next ask pupils to look at the zebras. Remind them that 3 zebras must be put into each box. Let them select the group that will permit 3 zebras to be put into each box. Some of the children may need to use objects and separate them into the required number of groups. Then let someone tell the number of zebras needed to make 2 sets.

Have pupils look at the third scene. Indicate the 2 boxes that are to be filled with horses and zebras. Point out that they have chosen a group of 4 horses and a group of 6 zebras to meet the requirements.

In the last scene, ask how the groups of horses and zebras have been rearranged into the 2 sets. Ask if the clerk could now put the sets into the boxes so that the customer would get what he wanted.

Continue in the same way for Movies B and C.

Page 235: Ask pupils to tell how many pandas and how many bears there are in the first scene of Movie D. Explain that these pandas and bears will fill one box and thus make one set. Get the children to note that there are 3 boxes to fill. Tell them to look at the second scene and select the group of pandas that will make 3 sets. Then have them select the proper group of bears. Each child may put a small object on the

groups selected to help him keep them in mind. Quickly check the books. Then ask someone to go to the board and draw circles and squares to represent the 6 pandas and the 9 bears needed to fill the boxes. Ask by what number the 2 pandas in the first scene were multiplied to get 6. Ask by what number the 3 bears in the first scene were multiplied to get 9. Ask how many boxes are to be filled.

Tell the children that in Movies E, F, and G, the first scene shows the animals that belong in one box. The second scene shows the number of boxes to be filled. Have Problem A read. Discuss it, and then call on a pupil to supply the answers. Continue in the same way for Problems B and C.

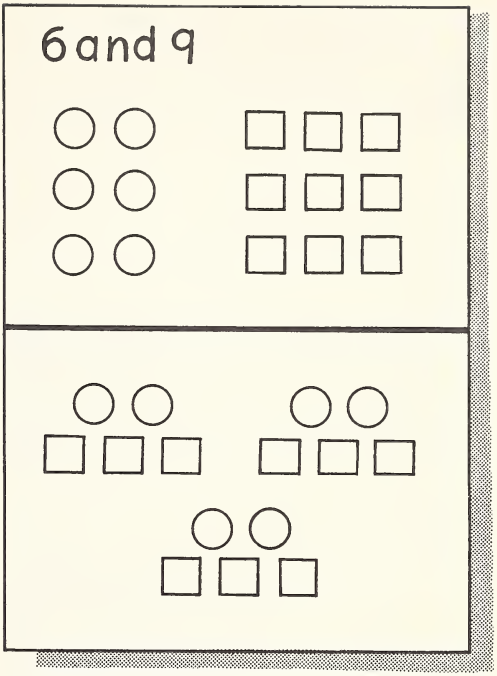
There are no pictures for Problems D, E, and F. Use them orally with the children. In these problems the children first must find the common multiplier. For example, in Problem D the children know that Ann put 2 chicken sandwiches into each picnic box. They are told that she needed 6 chicken sandwiches for all her boxes. By dividing the 6 chicken sandwiches into groups of 2, they discover there will be 3 groups. Consequently, Ann must have had 3 boxes. Since they now know the number of boxes, they can find the number of peanut butter sandwiches needed. Let the children use objects or make marks, if they need to, to solve these problems.

To complete the lesson, call on a pupil to read the statement beside the flag.

Providing for the able pupil

To give children more practice in finding common divisors, use this activity. So that the children may work independently without your direction, give them 3″ x 5″ cards on which you have written two numbers that can be divided by the same number. Combinations such as 10 and 15, 12 and 16, 6 and 9, 8 and 12, 6 and 15, 15 and 20, 12 and 15, and 10 and 25 can be used. Instruct pupils to write the numbers given them on the cards at the top left of an 8½″ x 11″ sheet of paper. Then tell them to make drawings showing the correct number of each of two kinds of objects, one kind for one number and one kind for the other number. They may make circles for one kind and squares for the other kind, or squares drawn with crayons of different colors, to show the groupings. Tell them to draw these two groups so as to show the objects divided into an equal number of smaller groups. (For example, 4 groups of 3, and 4 groups of 4, for 12 and 16.) They should use the upper half of the paper for this. Then on the lower half they are to make sets that show one group of each kind of object.

A sample drawing illustrating the numbers 6 and 9 is shown in the next column.



Helping the slow learner

On a table place a number of objects (pencils, toys, books, etc.) suitable for the number of children in the group. (For example, if there are 6 children, you might place 15 books on the table.) Then ask the children to divide the books and themselves into groups so that each group of children will have the same number of books. Suggest that the children arrange the books into equal groups (5 groups of 3 or 3 groups of 5) until they have found a grouping into which they can arrange themselves. Then tell them to arrange themselves into this *number* of groups (3 groups of 2). If each group of children can take a group of books, and no books are left over, the problem has been solved. If not, have them arrange the books into equal groups in another way, and try again to distribute them to the same number of groups of children. When they have successfully distributed the books, among themselves, let one child tell what number divides both the number of books and the number of children. Have him tell, too, the number of children and the number of books in each resulting set. Work through several problem situations of this kind. Let the children work in groups of two—one abler and one slower.

Expanded notes 233-235

236 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on pages 187-188.

Expanded Notes are not considered necessary for these lessons.

237-240 Moving forward

Lesson Briefs for this lesson ore on pages 188-190.

Overview

These pages constitute the child's formal introduction to fractions. The work on page 237 gives him an idea as to how both unit and non-unit fractions are obtained. Page 238 introduces the interpretation and the reading of such fractions. The work on pages 239 and 240 gives the child practice on these new ideas, and he also has the opportunity to form some generalizations about fractions.

Teaching the whole class

Page 237: To start this lesson, ask the children to name some things that are sold at a bakery. Let several of the children name different things that are sold. Ask them if they have ever bought part of a cake.

Tell them to open their books to page 237, where they will see some things that can be bought in a bakery. Direct their attention to the first scene of Movie A. Have them tell whether the picture shows a whole cake or just part of one. Ask them to look at the next scene and see into how many pieces the clerk has cut the cake. Ask them how many different people could buy these parts. Ask if all the pieces are the same size. Explain that the cake has been cut into three equal parts. Then tell them to look at the last scene. Get them to notice that one piece is being removed. Tell pupils that this piece of cake is one of three equal pieces and that we can say it is one third of the whole cake. Be sure to explain that each piece of this cake is one third of the whole cake. Ask pupils to point to another one third of the cake.

Ask the pupils to look next at Movie B. Ask how many cupcakes are in the group in the first scene. Ask into how many equal groups the cupcakes have been divided in the next scene and explain that the cupcakes have been divided into thirds. Ask how many of the groups the clerk is taking away. Ask how to tell how much of the group of 6 cupcakes the clerk is taking away. Help pupils see that they can have one third of a single thing (as in the cake above) or one third of a group (as in this group of cupcakes). In the last scene of the movie, point out the group of 2 cupcakes in brighter color (the two at the bottom). Get the children to see that this group of 2 is one third of all the cupcakes.

Movie C may be treated in the same way as Movie A. Have children note, however, that this cake has been divided into 4 equal parts in the second scene. In the third scene, get the children to see that three pieces of cake are in brighter color. Explain to the pupils that the hands are removing these 3 equal parts, or three fourths of the whole cake.

Movie D may be taught in the same way as Movie B. This time the children should note that there are 12 cupcakes. In the second scene they should see that the cupcakes have been separated into 4 equal groups. In the third scene, ask how many of the 4 groups of cupcakes are in brighter color. Get the pupils to note that these cupcakes are three fourths of the entire group.

Page 238: Have pupils look at the first scene of Picture E. Get them to observe into how many pieces the cake has been cut and that the parts are equal. Then have them look at the bottom part of the picture and find the piece that is in brighter color. Get the children to say that this piece is one third of the whole cake. Direct attention next to the text at the right and call on a pupil to read aloud the sentence that belongs to the figure 3. Have someone point out the three equal parts of the cake. Then have a pupil read the sentence that belongs to the figure 1. Explain that the two figures with the line between them show how to write "one third." Explain that the figure below the line shows into how many equal parts the cake has been divided and that the figure above the line tells how many parts we are paying attention to. Point out how the same idea is written in words directly below.

Pictures F to H and their accompanying text may be handled in much the same way. Be sure in each case that the children relate the numerator of the fraction to the undimmed part of the picture.

Page 239: Have pupils look at Picture A and read the accompanying text. Tell them to use the picture as they read to see what is being described and to find the missing number. Then call on someone to read the first problem and supply the missing number.

Problems B to L should be handled in the same way. When numerals must be supplied, have pupils come to the board and write them.

Page 240: Have pupils read Problem A and look at Picture A to find the answers. Tell them that the parts of the cake in brighter color will help them get the answer for the fourth line. Then call on a pupil to read Problem A aloud, saying the missing words and numbers. Continue in the same way for Problems B, C, and D.

Next let pupils take turns reading the fractions labeled A to M.

Exercises A to I should be assigned as written work.

Questions A, B, and C should be discussed by the class. They are meant to help the children make some generalizations about the relative sizes of parts of the same thing. If the children find it hard to answer these questions, draw (or have pupils draw) objects and divide them as indicated in each question. For Question A, for example, draw two equal circles to represent two cakes. Divide one into halves and the other into thirds. For Question B, you may put two groups of 12 small circles on the board. Draw rings around thirds in one group and around fourths in the other group.

If you draw circles to illustrate cakes for Question C, some of the children may not notice that three fourths of the cake is more than two thirds of the cake. Others may be more interested in the fact that three fourths of the cake gives them three pieces, while two thirds provides only two. Give them plenty of opportunity to discuss this problem.

The flannel board might help in showing the difference between two thirds and three fourths. (See directions for making the board, Activity 4, page 314.) You will need two circular pieces of flannel of the same size, one cut into three parts, the other into four parts. First put up the circle with three parts. Remove one part and show the remaining two thirds. Below this put up the circle partitioned into fourths. Remove one fourth to show three fourths. The children should be able to see that three fourths is a little larger than two thirds.

Another way to help visualize the difference between two thirds and three fourths is to fold a piece of paper into thirds and another piece of paper into fourths. When they are unfolded and the one in fourths is placed directly below the one in thirds, children can see that three fourths is more than two thirds.

Providing for the able pupil

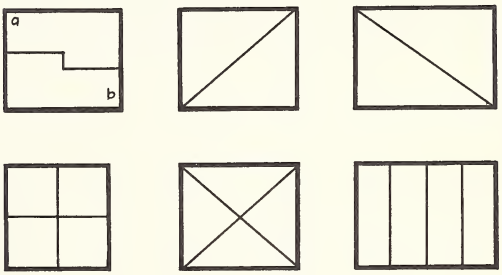
The following activity will help to develop judgment about relative sizes of fractions of the same thing. The activity involves use of the flannel board (see Activity 4, page 314, for directions for making the board).

Cut 8 large equal circular pieces of felt or flannel. Cut one piece into halves, another one into thirds, another into fourths, and so on until you have all the fractions through eighths represented. Leave the remaining circle intact and place it on the flannel board.

Next put one half of a circle on the board and let the children identify it as one half. They will probably do this readily; but if some do not, give a child the remaining one half and tell him to rebuild the circle. Do the same for the thirds, fourths, fifths, sixths, sevenths, and eighths, but not necessarily in ascending order. The children will find it hard to discriminate between some of these fractions; so allow them to rebuild the circles each time to prove what part of the circle they have been dealing with.

Another activity for the abler children will help them discover that a fraction of something—one half of a square, for example—is not confined to just one shape or position; that it may have many different shapes and occupy different positions. To get them started, ask the pupils to draw circles or squares of the same size on paper and show different ways of making halves. The children may draw around milk bottle caps or jar rubbers to make circles. After they have divided a few circles or squares into halves, let them show one another the different ways they discovered for making halves. Let the group discuss each way to see why it is right or wrong. Have some of the children divide their squares and circles into thirds, fourths, etc., in as many different ways as they can.

Below are shown some of the ways the fractions might be indicated by the children.



Helping the slow learner

To help these children recognize equal parts of a whole and to give them more visual experiences with fractions, let them try the following activity as group work. Cut paper into equal circular or square pieces. Divide them into different fractions (one into thirds, another into fourths, etc.). Mix up these pieces and give them to the group of children. Ask the children to see how quickly they can assemble a whole circle or square. When the circles and squares have been assembled, have the children tell the fraction into which each had been divided.

The following activity will give practice in recognizing fractional parts of a group. Draw or stamp a group of 12 objects on a card. On other cards draw or stamp the same objects, but now arrange them in

groups that show halves, thirds, fourths, and sixths. Hold up the first card of 12 and direct the children to find the card that shows sixths, that shows halves, etc. To extend this activity prepare similar cards for 4, 6, 8, 9, 10, 15, and 16 objects.

The slower children might also enjoy making their own drawings to show fractional parts through eighths. For these they should be instructed to draw circles (using a bottle top as a pattern) or squares, dividing them into halves, thirds, etc., and coloring parts to show one third, two thirds, etc., with labels. These should be exhibited around the room when they have been finished.

241 Using arithmetic; Thinking straight

Lesson Briefs for these lessons ore on poge 191.

Expanded Notes are not considered necessary for these lessons.

242 Side trip

Lesson Briefs for this lesson ore on poge 192.

Expanded Notes are not considered necessary for this lesson.

243 Thinking straight; Keeping skillful

Lesson Briefs for these lessons are on poge 193.

Expanded Notes are not considered necessary for these lessons.

244-245 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 194-195.

Expanded Notes are not considered necessary for these lessons.

246-249 Looking back

Lesson Briefs for these lessons are on poges 195-198.

Expanded Notes are not considered necessary for these lessons.

250-251 Checking up

Lesson Briefs for these lessons ore on poges 198-201.

Expanded Notes are not considered necessary for these lessons.

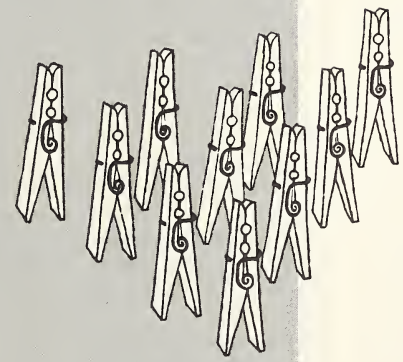
Activities

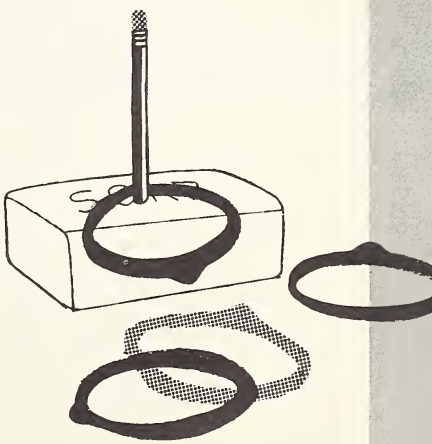
This section of the *Teaching Guide* contains suggested activities specially designed to extend the child's concepts and generalizations about arithmetic. Specific references are made to these activities in the Expanded Notes.

The activities are arranged in the order of their use in the Expanded Notes and are numbered to make reference to them easier.

You will undoubtedly discover new ways of using these activities and ways of adapting them to other topics.

You will also be sure to think up other activities as good as or better than the ones described here.





Activities

Useful arithmetic activities

are those that lead to good thinking and generalizations. They should not require time-consuming and mechanical work. They should be directly arithmetical.

	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

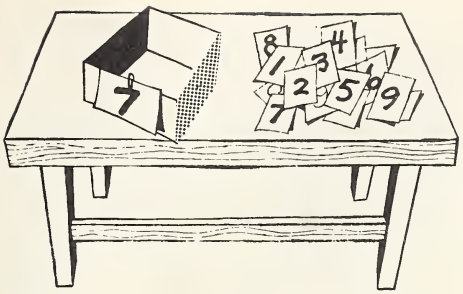
Activity 1

Number box

The following materials will be needed for this activity: one fairly sturdy box (such as a chalk box or cigar box), two sets of cards numbered from 1 to 9, and a set of group-label cards with much larger numerals on them. The latter should be for the numerals 2 to 18, to represent the number groups from 2 to 18.

To start this activity (supposing you are using it for addition basic facts in the 2, 3, 5, and 7 groups), clip a group-label card, such as 5, to the box. Place the box so that everyone can see the number on it. Then give a pupil the two sets of cards numbered from 1 to 9 and ask him to select two of them (such as one with 2 on it and one with 3 on it) that will make up an addition basic fact for the 5 group. Have him drop these cards into the box, saying the complete fact as he does so (2+3=5). (For variation write equations such as 2+3=▒ on the cards the child is given; in this case, the child has only one card to select and needs only one set of cards.)

For slower pupils, it may be helpful to provide about 20 small objects, such as blocks, corks, or jacks. Let one of these children drop the proper groups of objects into the box (2 objects, then 3 objects), saying "2+3=5."



Although this activity has been designed to provide practice on addition basic facts, some of the same materials may be adapted for the multiplication basic facts presented in this book. When used for multiplication, the box labels, or group labels, must also include numerals for the number groups 20, 21, 24, 25, 27, 28, 30, 32, 35, and 36. In place of the two sets of cards showing single numerals, you will need one set of cards showing the equation without the answer for the multiplication facts through the 36 group (for example, $3 \times 7 =$ ▒). The child should select the card showing a fact that will equal whatever answer you have clipped to the box, drop this card in the box, and say the complete fact as he does so.

Slower pupils, working with objects, should—for the answer 21—pick up a group of 7 objects three times, saying "3 groups of 7=21; $3 \times 7 = 21$." They might also pick up a group of three objects seven times, saying "7 groups of 3=21; $7 \times 3 = 21$."

The activity described in the above paragraphs may be varied in one of the following ways. For the box, substitute a chair representing the engine of a train. Clip a group label on the "engine" and let the class discover how many "cars" (chairs with basic facts clipped to them) can be attached to this particular "engine." If simple art work holds no terrors for you, you might even cut out a cardboard engine and stand it on the chalk ledge, leaning it against the board. To this engine you would clip, in turn, the various number-group labels. Children would then select cards showing the appropriate facts in equation form and line them up like cars behind the engine. The number-group card might also represent a cowboy, and the basic fact cards might represent ponies. The special interests of your pupils may suggest many other variations of this activity. This activity has the advantage of generalizing, or summarizing, the basic facts for the group or groups under consideration. Such generalizations are valuable in establishing a complete idea of the basic facts.

Activity 2

Basic fact charts

Able pupils may keep a chart of all the addition basic facts. Columns are to be headed with numerals from 2 to 18, each heading representing a number group. When facts for a particular group have been learned, the child should write them in equation form on his chart, under the appropriate heading. As the charts are filled in, pupils will be able to make a number of observations about the various groups, such as (1) the greater number of facts in one group over another; (2) the reverse order of the numbers added; (3) that each group from 2 to 10 has one fewer fact than the value of the group numeral itself; (4) the number of facts for each group from 11 to 18.

ADDITION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1+1	1+2 2+1	3+1 1+3 2+2	2+3 3+2 4+1 1+4	3+3 4+2 2+4 5+1 1+5	6+1 1+6 5+2 2+5 4+3 3+4	7+1 1+7 6+2 2+6 5+3 3+5 4+4	8+1 1+8 7+2 2+7 6+3 3+6 5+4 4+5	9+1 1+9 8+2 2+8 7+3 3+7 6+4 4+6 5+5	9+2 2+9 8+3 3+8 7+4 4+7 6+5 5+6	9+3 3+9 8+4 4+8 7+5 5+7 6+6	9+4 4+9 8+5 5+8 7+6 6+7	9+5 5+9 8+6 6+8 7+7	9+6 6+9 8+7 7+8	9+7 7+9 8+8	9+8 8+9	9+9

A similar chart may be kept for the basic facts in subtraction, multiplication, and division.

Headings for the subtraction chart will be the same as the headings for the addition chart.

Headings for the multiplication chart will require more space, since 20 columns must be provided. Multiplication headings will be 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 24, 25, 27, 28, 30, 32, 35, 36.

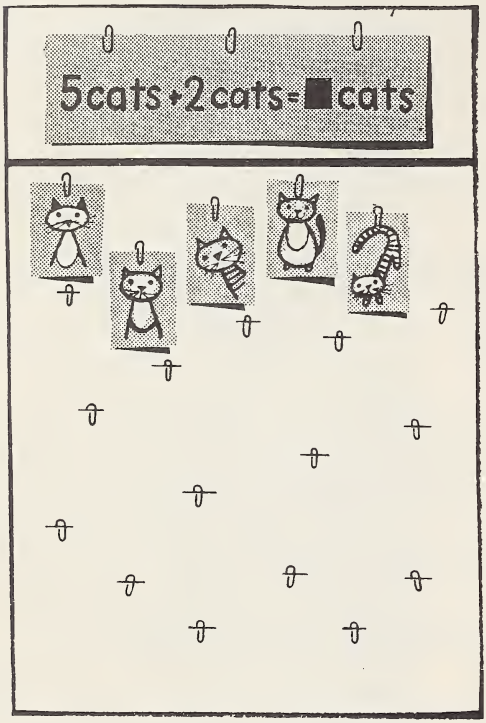
Headings for the division chart will be the same as the headings for the multiplication chart.

Activity 3

Story cards

For this activity you will need two large sheets of oaktag (24″ x 36″) and about eighteen 3″ x 5″ cards in some bright color. Use one of the oaktag sheets as a card-holder. Make three small horizontal slits 2″ from the top. Make two of the slits 6″ from either side of the 24″ width and the third one in the middle. Fasten a paper clip through each slit. These clips will hold "story cards" which may be cut from the remaining sheet of oaktag. Divide this second sheet first into two sections, each 18″ x 24″; next cut each of these sections into four pieces, each 6″ x 18.″ This will give you eight cards on which to print basic facts in story form. You may use both sides of a card. Only one "story" should appear on a side, and all the "stories" should be incomplete, that is, without an-

swers. For example, "5 cats + 2 cats = ▤ cats." When you have attached one of the story cards to the top of the card-holder, you will be able to judge how much space there is left. Scatter slits haphazardly throughout this remaining space, and insert a paper clip in each one.



To start this activity, insert one of the story cards at the top of the card-holder. (You may let the children choose the story they want you to use.) Then a child should look at the story, decide what the answer is, and take as many cards from the pile of colored cards as there are objects in the answer. These small cards should then be clipped to the card-holder. If the story card is about cats, they are to imagine each small card as representing one cat. Children should not pick up cards and clip them to the holder one by one, but should pick up as many as they need to complete the story before approaching the card-holder. The cards should be placed on the holder in groups, and as the child completes the first group of 5, he should call out what it is, such as "5 cats." As he finishes attaching the next group of 2, he should say, "plus 2 cats equal 7 cats." Then he should be required to put this statement in abstract form: "5 plus 2 equals 7."

This activity may be adapted for subtraction by having children remove the required number of cards from a total group they have clipped to the oaktag board.

To adapt the activity for division, put only the abstract fact, without the answer, on the story card ($9 \div 3 =$ ▤). Then have the child (a) clip the entire group on the board, and (b) separate this group into the required number of subgroups.

Story cards for practice in multiplication should also be limited to the basic fact without the answer, such as $3 \times 3 =$ ▤. To illustrate this fact the child should pick up cards in groups of 3 and fasten them to the board in such a way that they do not appear as 3 separate groups of 3, but as one group of 9.

Activity 4

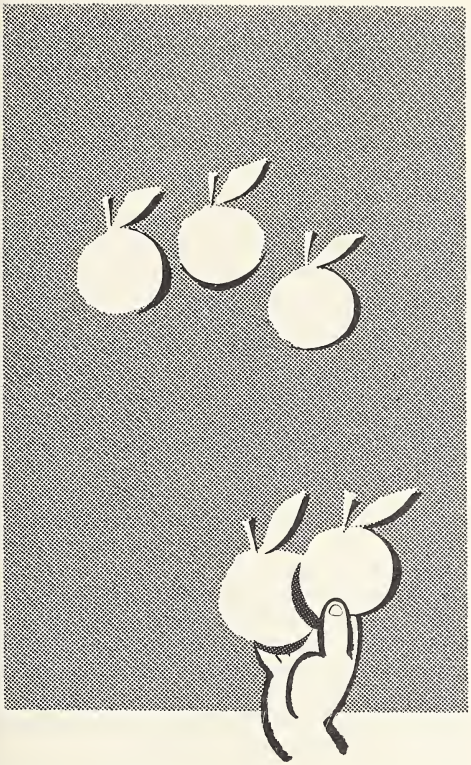
Flannel board

A sturdy felt board or flannel board is a worth-while device in the classroom, since it can be used many times throughout the year. Besides being a useful device for demonstrating the addition and subtraction basic facts with cutouts, it may be used to provide experiences in the meaning and relationship of fractions.

Five eighths of a yard of 36″ flannel or felt in a dark color will be sufficient to cover a 24″ x 36″ piece of heavy cardboard or easelboard. Cutouts to be used with this board may be made of either oaktag, felt, or colored construction paper. (Short lengths of felt in a variety of colors are sold in most hobby shops.) If you use oaktag for cutouts, glue a small strip of coarse sandpaper to the back of each cutout. This will cause the oaktag to stick to the board when given a slight downward pressure.

When using the flannel board for practice on the subtraction facts for the 2, 3, 5, and 7 groups, for example, you will need at least 7 cutouts of each of a number of different objects—apples, birds, etc. Let a pupil place a group of cutouts on the board, saying the number as he does so, such as "3 apples." Then have him remove part of the group, describing the action and the resulting remainder—for example, "minus 2 apples equal 1 apple." Have him next state the action and result in abstract terms (3 minus 2 equals 1).

This activity may be varied by using the story cards from Activity 3. Let a child choose a story card con-



taining a subtraction basic fact, and then select enough cutouts of one kind to demonstrate his story. Have him read the problem silently, then demonstrate it on the flannel board. He may ask another child to describe the action and result in words, and still another child may be asked to put the statement in abstract form.

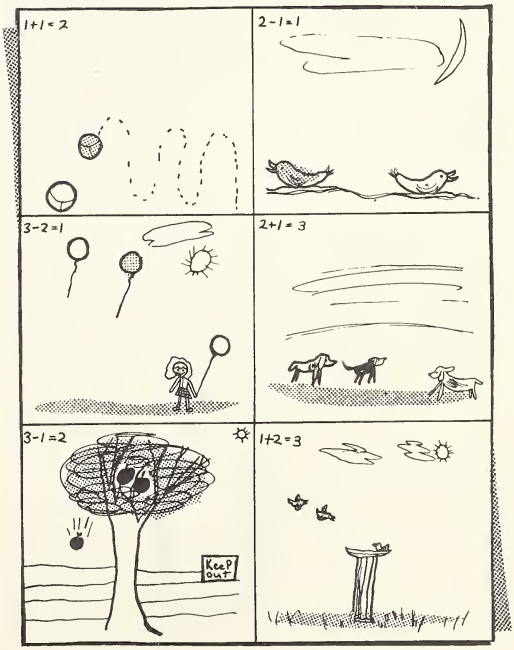
You may also adapt any of the above suggestions for addition basic facts.

Activity 5

Picture book

As soon as the addition and subtraction basic facts for a group have been learned, children may enjoy illustrating them on pages which they can eventually make into a booklet. For the 2 and 3 groups, you will need to provide each child with a piece of drawing paper that has been divided into 6 rectangles arranged in 2 columns of 3 rows. Have the child write the facts for the 2 group (1+1, 2−1) in the top row, writing one fact in the top left-hand corner of each rectangle. In each of the remaining rectangles, have him write in similar fashion one of the addition or subtraction facts he has learned for the 3 group (2+1, 1+2, 3−1, 3−2). Make sure that he has used all the facts for these groups before allowing him to proceed. Let the class discuss the kind of action to be shown in the illustration of each fact in the top row —a combining action for the addition fact, a separation of groups for the subtraction fact. Then let pupils use their crayons or colored pencils to draw any objects they like to illustrate the facts on their pages. The picture below shows how a completed page might look. Emphasis should not be put on the art work, but on how well the picture illustrates the basic fact.

Children may work independently in completing their booklets. For some of the subsequent groups, the child may need as many as two or more pages to provide a rectangle for each fact in the group he has to deal with. Except for the 2 and 3 groups, each new group should be started on a separate page. Let children work on these illustrations whenever they have time. It is not necessary for them to complete all the illustrations for a particular group in one day. It may be wise, however, to have them hand in pages as they are completed, so that you may keep them safely until all of the pages are ready to be made into booklets.



If loose-leaf covers are prepared beforehand, each child can put his pages into his book as he finishes them. The work will be completed when all the addition and subtraction basic facts through the ten group have been illustrated.

The activity may be extended into higher groups, unless you think the number of objects in them is too large to illustrate conveniently.

Activity 6

Puzzle cards

The following activity will test not only the able child's knowledge of addition and subtraction basic facts, but also his ability to perceive a pattern of relationship within a series of answers. Slow learners should not attempt this activity.

On each of a number of 4″ x 6″ cards (one card for each child who is capable of carrying out this activity) write 25 basic facts (without answers) in 5 equal rows. You will, of course, be careful to use only the basic facts studied so far. Arrange the horizontal rows so that *all but one* of the unwritten answers will be in some definite order, such as 2, 3, 4, 7, 5, or 8, 6, 4, 2, 3. In the first example, the 7 does not belong in the sequence; in the second example, 3 is the number that does not belong. Label each row with a letter and put a number on each card. No two cards should be exactly alike. (Two sample cards are shown below.)

					Card 3
A	5-4=	5-3=	5+2=	1+2=	5-1=
B	5-1=	1+2=	2-1=	3-1=	3-2=
C	5+2=	7-2=	4+3=	5-2=	2-1=
D	1+1=	5-4=	3-1=	7-6=	3+2=
E	2+1=	3-2=	5-2=	7-4=	1+2=

					Card 4
A	5-4=	7-4=	4+1=	3-1=	2+5=
B	1+6=	2+3=	4+3=	2+5=	3+4=
C	7-5=	5-3=	2-1=	3-1=	1+1=
D	1+1=	5-2=	7-3=	7-4=	1+4=
E	1+2=	3-1=	5-1=	2+3=	7-1=

When an able pupil has finished his regular assignment, let him choose one of these cards to work on. Explain to him that the *answers* to the facts in each row will form a regular pattern if he leaves out one of the facts that appears in the row. Warn him that one row may not have the same kind of pattern as another row, and explain that the first thing he must do is discover what the pattern is, in the row he is working on, by comparing one answer with another. Then he is to name the one fact in each row that spoils the pattern, or sequence, of answers. He will do this on paper, writing on his paper the number of the card he is working on, and then printing the letters A to E in a column at the left. Have him write the 5 completed facts (such as $5-4=1$) in a row opposite the proper labels, then study the answers to these facts and cross out the one fact that does not belong in the row. You may need to help him discover the pattern in the first row he works on.

As pupils become proficient at this activity, and as more basic facts are studied, the children may make their own cards. Multiplication and division basic facts may be included.

An answer card may be prepared by dividing a 4″ x 6″ card into rectangles. Write a card number at the top of each rectangle, with the letters A to E in a column below it. Then write the one fact that should be omitted in each row after its letter. By using the answer card, the child will be able to see whether or not he has made the correct decisions.

Activity 7

Puzzle stories

The following activity provides practice on the basic facts.

Make up several stories similar to the one below and type them on separate 4″ x 6″ cards. (Be sure to use only words that are in the child's reading vocabulary.) In each place where a number representing a sum or a remainder occurs, label this space with a letter. Then give each card an identifying number.

Let each child select one or more cards. Tell him to write the number of the card on his paper, and below this number to write in a column the letters from the blank spaces. As he reads the story, he is to write the missing numbers opposite the appropriate letters on his paper.

These stories may be used as supplementary work from time to time.

To adapt this activity for slow learners, provide story cards with fewer blanks to be filled in.

"Five rabbits were in the garden. After a short time two more rabbits came into the garden. I wonder if the farmer knew that (A) rabbits were in the garden. It wasn't long until the farmer saw the rabbits and chased four of them away. That left only (B) rabbits in the garden. When the rabbits that had been chased away saw that the farmer had gone, they came back to the garden. Then there were (C) rabbits in the garden. Two of the rabbits got tired and went home. That left (D) rabbits in the garden. Two rabbits were afraid that it was getting late, so they went home, too. Then only (E) rabbits were in the garden. It wasn't long before two rabbits came back because it wasn't as late as they thought it was. Then (F) rabbits were in the garden."

Card 1

Activity 8

Trouble spots

Individual practice cards, containing only such basic facts as each child finds difficult, provide a more stimulating activity than classwork with cards having all the basic facts on them. Let children put facts they find troublesome on small pieces of drawing paper. Have them print the fact in equation form (without the answer) on one side of the card, reverse the card and show the picture form of the fact and the fact with the equation completed. If a diagonal piece is cut uniformly from a corner of each card, you can arrange them easily with all answers face down.

A pupil can use these cards in his spare time, working alone, or he can use them in practice sessions with a partner. As new basic facts present difficulty, new cards may be added to the individual packs. As soon as a pupil has learned a particular fact, he should remove the card from his pack. Encourage him to eliminate cards as quickly as he can.

Commercially prepared cards, for both individual and class use, are available (in computational form only).* The most useful of these cards are those that show the basic fact with the answer on one side and the basic fact without the answer on the other side.

**Arithmetic Flash Cards for Individual Use* (2″ x 3½″, in envelopes); Set 5: Addition and Subtraction (200 cards); Set 6: Multiplication and Division (190 cards). Scott, Foresman and Company.

Arithmetic Flash Cards for Class Use (4″ x 7″, boxed); Set 1: Addition (100 cards); Set 2: Subtraction (100 cards); Set 3: Multiplication (100 cards); Set 4: Division (90 cards). Scott, Foresman and Company.

Activity 9

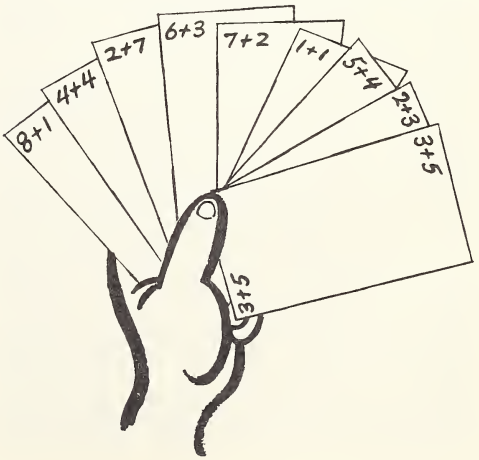
"First out" game

The following game may be played by 2, 3, 4, or 5 children who have completed work on addition facts for the 10 group. The game may also be adapted to provide independent practice on subtraction facts through the 10 group.

Cut 45 cards (3″ x 5″) in half. This will give you enough small cards to make two complete sets of the addition facts through the 10 group. You will need two sets if as many as five children are playing the game. If not more than two are likely to play at the same time, one set will do. To make one set of cards, write each addition fact in equation form (without the equals sign and answer) in opposite corners of one card. The picture below shows what the cards might look like when they are completed.

To play the game, give each child 9 cards, and put the remaining cards in a pile which can be reached easily by each player. Tell the children to look through their cards for winning sets. A winning set is 3 or more cards that have the same answer. Such sets should be placed together in the hand (for example, 7+3, 6+4, and 8+2). Remind them that cards that belong to the same number group must have the same answer.

Explain that the object of the game is to get rid of all cards by laying down a winning set or sets each time the player has a turn to play. If a child has one set of 3 or more winning cards in his hand, he lays it down when it is his turn to play. The play then passes to the next player. If a player has put down a winning set, he may put with the set one or more cards with



the same sum at a later turn at play. If he cannot lay down a winning set, he may draw any number of cards up to 3 from the pack and then discard the same number of cards as he drew. Then he must await his next turn at play. If all the cards in his hand make a winning set or sets when it is his turn to play again, he can lay them all down. The first player to lay down all his cards is the winner. The other players should check each time a winning set is laid down to be sure that the cards are being laid down according to the rules of the game.

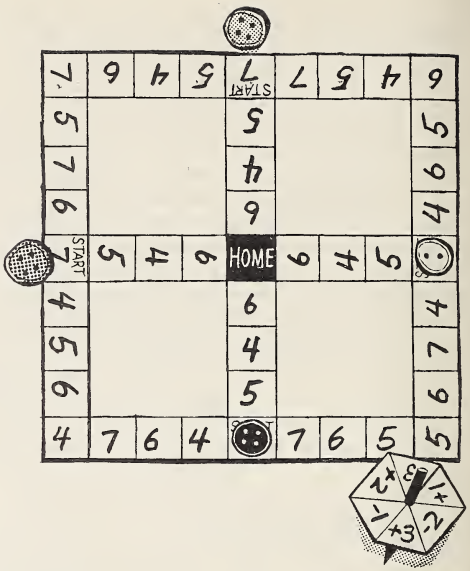
When playing with cards that have the subtraction facts on them, a player will also need to save cards whose answers are the same. The game can be varied by using a mixture of addition and subtraction cards. A winning set is three or more cards with the same answers—sums or differences.

Activity 10

"Number top" game

The game Number Top may be played by two, three, or four children who have completed work with all the groups through 10. Each child will need one small marker, such as a stone or a button. The board you will need may be made from a piece of oaktag about 9″ square. You will also need a hexagonal spinner. Use a peg stick for the axis of the spinner. You can cut the spinner from an oaktag circle marked off in 60° arcs. (See illustration in the next column.) The numbers 1, 2, and 3 should be written twice on the spinner, once with the plus sign and once with the minus sign.

To play the game, each child puts his marker on one of the squares marked "Start." The squares marked "Start" also have the numeral 7 on them. One child starts by spinning the spinner. When it stops at a number, the child must add or subtract this amount from 7. The sign in front of the number indicates whether he is to add or subtract. If the answer he gets is an odd number (5 or 7), he must stay where he is. If his answer is an even number (4, 6, 8, 10), he may move to the next square. For example, if the spinner stops at −3, the child subtracts 3 from 7 (the number on the starting square). Since the answer, 4, is an even number, he moves his marker to the next square, and the next player takes his turn. If the answer is an odd number (1, 3, 5, 7, 9), the child does not move his marker, and the next player takes his turn. The player either adds the number on the spinner to or subtracts it from the number on the square where his marker is.



The object of the game is to go all the way around the board back to where the player started, and then to go up the center to the place marked "Home." The winner is the child who gets "Home" first. He must move his marker completely around the board counterclockwise.

Activity 11

Equation chart

From pictures in the book, have children make a chart of the multiplication and division facts studied so far, including those for the 10 group. Tell children to work with the pictures on pages 18, 20, 23, 24, 28, 32, and 33.

To start a pupil on the multiplication part of the activity, have him write the following five headings across the top of his paper: *Picture, Number of Groups, Size of Group, Total Number,* and *Equation.* Then have him look at Picture D on page 18. Tell him to write the page number and picture letter under the first heading on his paper. Then have him use the picture to determine what figures he is to write under each of the other headings. When he reaches the heading "Equation," remind him that the *number* of groups is placed on the left side of the times sign, while the *size* of the groups is placed on the right side of the times sign. A portion of the multiplication chart is shown on the next page.

Picture	Number of Groups	Size of Groups	Total Number	Equation
18, D	2	3	6	2×3=6
18, E	2	2	4	2×2=4
18, F	3	2	6	3×2=6

For division, the chart headings should be as given below. A portion of the chart has been filled in.

Picture	Total Number	Size of Groups	Number of Groups	Equation
20, D	6	3	2	6÷3=2
20, E	6	2	3	6÷2=3
20, F	4	2	2	4÷2=2

Activity 12

"Add-up" game

To provide independent practice for pairs of pupils on the addition basic facts through the 10 group, the game of Add-Up may be introduced. You will need to prepare an Add-Up "board" and 2 sets of 24 small sum markers.

The board may be made of cardboard or oaktag 8½″ x 11″ divided into 9 horizontal rows and 5 vertical rows of spaces. In each rectangle one of the addition basic facts through the 10 group is to be written twice, so that it can be read by players on opposite sides of the board. (See illustration in the next column for suggested layout of the board.)

Markers, made of paper or oaktag, should be small enough to fit in each of the rectangles on the board. To prevent the two players from getting their markers mixed up, the two sets of 24 should be in different colors, perhaps red and blue (or one set square and the other set round). For each set, prepare one marker with a 2 on it, two markers with a 3 on them, and three markers for each of the remaining numerals from 4 to 10.

The markers are placed face down on the table. Each player takes a turn by drawing a marker of the color (or shape) he has chosen. After taking a marker, the player is to look for a basic fact on the board that "adds up" to the number on the marker. He is to place his marker face up on the rectangle on which the matching fact appears. If a player draws a number group that fits none of the basic facts left uncovered, he must put this marker aside and let his opponent take his turn. Once a square is covered by a player, his opponent may not put a marker on the same square. The game proceeds until all markers have been drawn and either placed on the board to complete a basic fact or laid aside. The winner is the player who has covered the greatest number of facts on the board.

Additional boards and markers may be prepared if it seems desirable for more than one pair of children to play Add-Up at the same time.

1+7 4+1	3+5 5+3	8+2 2+8	5+1 1+5	1+8 8+1
9+2 2+6	6+3 3+7	7+5 5+4	7+9 6+4	7+3 3+4
2+5 5+2	2+2 2+2	1+6 7+1	2+1 1+2	7+2 2+4
1+3 3+1	9+3 3+6	1+5 5+1	8 	6+1 1+9
7+7 4+4	9+1 1+6	1+2 2+1	3+6 7+3	2+3 3+2
3+2 2+3	9 	3+7 4+3	3+3 3+3	5+5 5+5
5+7 4+5	1+1 1+1	8+1 1+8	3+9 6+3	1+9 6+1
2+7 4+2	5+3 3+5	5+2 2+5	1+6 9+1	3+1 1+3
6+1 1+6	2+8 8+2	7+1 1+4	6+2 2+7	9+7 4+6

This game can be adapted to basic facts beyond the 10 group by changing the facts shown on the board and by supplying different sets of numbered markers.

Activity 13

"Number bowling" game

Place 10 clothespins (standing type) on a table in the usual bowling formation. Let children take turns rolling a small rubber ball (or golf ball, or table-tennis ball) to see how many they can knock down.

Have another player ready to pick up the clothespins that are knocked down before they can be counted, so that the only way to determine how many have been knocked down is to subtract the number standing from 10. Instruct the child who rolls the ball to close his eyes as soon as his hand lets the ball go. He may open them as soon as another player has

picked up the clothespins he has knocked down. If the child who rolled the ball gives the correct answer, he gets a point. Then the next player takes his turn. The first child to get 10 points wins the game. One child in the group may keep score for everyone.

Activity 14

"Make up problem" game

Able children may take turns giving each other unsolved equations for which problems must be invented. (It will be helpful if you can provide this group with a 3-minute egg timer from the dime store, a stop watch, or a watch or clock with a second hand.) Let one child do the timing and experiment with lengths of time of 1 minute to 3 minutes to determine how much time should be allowed. The child who is "It" will write an equation without the answer on the board. Then he will point to a child in the group and ask him to make up a problem to fit the information on the board. If the child can think of a problem and give the answer before the time is up, he becomes "It." If he cannot think of a problem, the child who is "It" may ask another child to make up a problem.

All children in this group will have the teacher's rôle of verifying answers. Before putting the group on their own, make sure they understand that the numbers they use must be within the range of the basic facts studied so far. The child who is "It" the most times is the winner.

Activity 15

Number chart

A culminating activity for the study of two-figure numbers might be the making of a number chart of the numbers 1 to 99. You will need to prepare these materials in advance:

1 large oaktag chart marked into 10 horizontal rows and 10 vertical rows of spaces. The picture on page 321 shows these spaces.

20 each of the numerals 1 to 9 and 9 zeros. These may be printed on paper rectangles or cut from calendars. The numerals should be small enough so that two of them can be placed side by side without extending beyond the dimensions of one of the rectangles on the chart.

Place the blank chart on a bulletin board, low enough so that every child can reach the top of the chart. The sets of numerals should be placed nearby, but the piles should not be arranged in numerical order.

To get the activity under way, ask someone to count from one to nine. After he does so correctly, ask this pupil to find the corresponding numerals, and thumbtack them on the chart, beginning with the first row at the left side, *second box from the top,* and going downward. Then ask another child what number comes next. When he says "10," ask him to put this number in the second row from the left side, in the top box. Now ask him to go on and say all the teen numbers. When he finishes, ask him to find the numerals that make these numbers and thumbtack them on the chart in the second row. When he finishes putting on number 19, ask another pupil what

number comes next and let him go on saying all the numbers in the twenties. Have him thumbtack these numerals in place.

Continue in the same way until all the numbers to 99 have been thumbtacked on the chart. Have the class check the chart to make sure it has been done correctly. Point out that each top number going across gives the decade name for all the rest of the numbers in its column. When some of the children have leisure time, you might ask them to take the chart down and paste the numbers in place so that the class will have a number chart for display and reference. When completed, the chart should look like the drawing below:

	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

Number charts may be made in other arrangements. Another arrangement, in which the numbers are arranged in horizontal rows, is shown below. (This chart does not have the advantage of having the decade numbers—10, 20, 30, 40, etc.—across the top, from which all the numbers in the rows below them get their decade names.) This arrangement of the chart does, however, have the advantage of putting the decade numbers (10, 20, 30, etc.) at the end of the decade to which they belong. You may present whichever chart you wish, or you might even present both. It may be profitable to let the children help decide which one to use and give reasons.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

Activity 16

Number system pictures

When studying the number system, able pupils may enjoy making drawings to illustrate the meaning of numbers. For two-figure numbers, for example, they can illustrate groups of tens and ones in the upper half of a sheet of paper by drawing large boxes for tens and smaller boxes for ones. In the lower half of their papers, pupils can draw a tally space and put in it the correct number of tally marks for the number being illustrated. The appropriate numeral should then be written below this tally space. Drawings showing 22, 33, 44, 55, 66, 77, 88, and 99 objects arranged in groups of tens and ones are especially helpful in stressing the idea that the same tally mark or numeral can stand for 1 thing or for 10 things. Completed drawings may be exhibited in the classroom, where they will provide additional experience for all the children in seeing what the numbers mean.

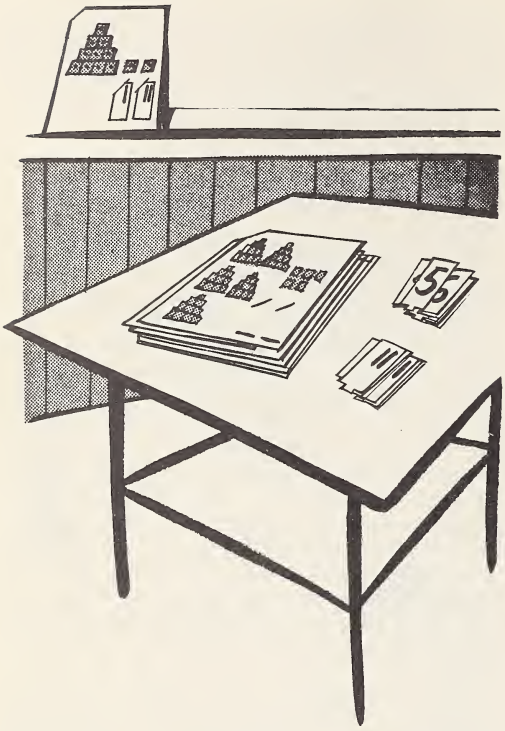
To avoid repetitions of illustrations for the same number, you could write on cards the numbers you think should be illustrated, and let each child choose a card. He could then make a drawing to illustrate the number on the card he chose.

Activity 17

Number system matching

In the following activity, you may use either specially drawn cards showing objects grouped in tens or ones, or the *Arithmetic Readiness Cards, Set 2: The Number System.* (See illustration on the next page. For description, see page 232.) The commercially prepared picture cards are provided with slits in the lower corners for the insertion of the tally-mark or number cutouts that are included with the set.

To start the activity, place a pile of picture cards on a table and beside it place a stack of tally-mark cutouts and a stack of numeral cutouts. (The tally-mark cutouts will contain from 1 to 9 tally marks; cutouts are of individual figures from 0 to 9.) Instruct a pupil to take the first picture card, find the tally-mark cutouts that belong with the picture, and fasten them in the card. When he has done this success-



fully, the card may be placed on the chalk ledge so that other children can see it. When each child has had one or two turns and the tally marks have all been inserted, they may be replaced by the correct numerals from the stack of number cutouts.

Many other activities based on cards of this type are suggested in the Teacher's Guidebook to the *Arithmetic Readiness Cards, Set 2: Number System.* Use the ones suitable to your class.

Activity 18

Number sequence

Another activity, to be used with the cards described in Activity 17, gives practice in the sequence of numbers. Shuffle the cards so that they are out of order, and then give each child five or more cards. Explain that you want each child to find the card that shows the smallest number of things and put that card on the left side of his desk, then to find the card that shows the next larger number and put it beside the other one in a straight line, until all the cards have been arranged in sequential order.

Activity 19

Number breakdown

As a challenging activity for abler students, suggest that they discover all the possible ways to rewrite such numbers as 99, 87, 76, etc., in terms of tens and ones, without changing the value of the numbers. You might ask them to make a chart. Have them write the number they want to demonstrate at the left of their papers. Then to the right have them write the headings "tens and ones." For the number 99, for example, such a chart would look like this when it is completed.

99	Tens	Ones
	9	9
	8	19
	7	29
	6	39
	5	49

This activity can also be used for three-figure numbers. The child would then head his columns "hundreds," "tens," and "ones." Restrict the work to ten ways for each number.

Activity 20

Number "spelldown"

To give children more practice in changing tens into ones and ones into tens, and in thinking of numbers in these terms, let them have a spelldown in the manner described below. Let the children first "number off," with the "odds" on one team and the "evens" on another.

Start the game by having the leader of one side ask the leader of the other side to change 5 tens 16 ones into its numerical form (66). If the opposing member does so correctly, it would be his turn to ask the next person in the first team to change a group of tens and some ones into their numerical form. When a player misses, he must sit down and give the next member on the opposite side a chance to answer. The child who remains standing at the end is the winner.

The game may also be played by giving a number—for example, 34—and asking that it be changed to

tens and ones in such a way that the ones number will be more than 9.

It may be advisable at first for the teacher to call out the numbers, as "6 tens 18 ones," "7 tens 21 ones," etc.

This game can also be adapted to numbers of three figures by using such combinations as "3 hundreds 14 tens 8 ones."

Activity 21

Buy it

When studying money, some children may need more practice in finding ways in which amounts of money can be made up in various combinations of coins.

For this activity, provide some cards identified by numbers and have some familiar object, such as a toy or a book, drawn, pasted, or stamped on each one. Cards should also show the price of the object.

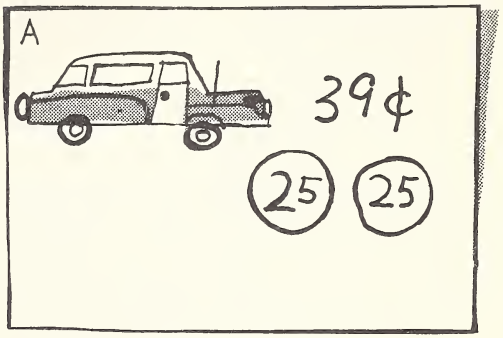
Let a child select a card and then show on his paper (which he should mark with a number to match the card chosen) what coins he might use to make up the required sum. Have him draw circles to represent the coins. On each coin circle he is to write the number of cents the coin represents (1 for penny, 5 for nickel, 10 for dime, etc.). Tell the child to make as many different combinations of coins as he can for the amount specified on the card.

Activity 22

Change-making cards

To give practice in making change, prepare 4″ x 6″ cards, as follows: on each, draw or stamp an object that is for sale for less than one dollar, mark it with its price tag, and draw coins that might be used in paying for it. The total amount of the coins shown must be *more* than the amount shown on the price tag, since the cards are being prepared for a change-making activity.

If you wish to have the children help in making these cards, discuss with them some of the toys that can be bought for less than one dollar. Select toys that are easy to draw and list them on the board. Let the children decide the price of each toy. Write these prices on the board opposite the listed toys. Then give each child one or two cards or pieces of oaktag, and have him draw a toy with its price tag. (Be sure he understands that no toy may cost more than one dollar.) Tell him to draw one or more circles on his card for the coins that might be used in buying the toy. The child should show what each circle represents by writing a numeral on it (1 for penny, 5 for nickel, 10 for a dime, etc.). Each card should be identified by a letter or number.



When the cards have been made, let each child select a card. Have him write on his paper the letter or number that identifies the card. Then have him show which coins he would use in making change by drawing circles (for coins) and writing in each of them the number that indicates the value of the coin.

Cards like those illustrated above may be used from time to time as supplementary work. They should be arranged in sets, according to their difficulty, for use with the various groups of children. Let the children use cards they have not used previously.

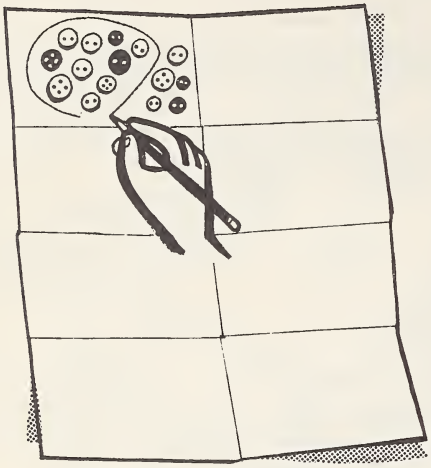
Activity 23

Teen pictures

The following activity will give children practice in identifying groups of objects from 11 to 19.

Let the children work in pairs. They will need a box containing 19 objects and a large sheet of paper, such as newsprint, that has been folded as shown in the picture on the next page. (The paper should be folded first in half, next in quarters, and then folded one more time, so that when it is spread out the creases will show 8 sections.) The children should take turns dropping a handful of objects on a section of the spread-out paper. After one child has dropped some objects, the other child should discover, without counting, how many objects have been dropped. When there are more than 10 objects, the child is to draw a ring around 10 of them or separate the ten with a piece of string; and by noting the number of ones left over, he should be able to write the teen number immedi-

ately. The total number of markers dropped in each section of the paper should be written in the lower right-hand corner of each section. Both sides of the



sheet may be used. Since practice in finding ten and ones in teen numbers is desired, instruct the children to take "big handfuls" from the box.

Activity 24

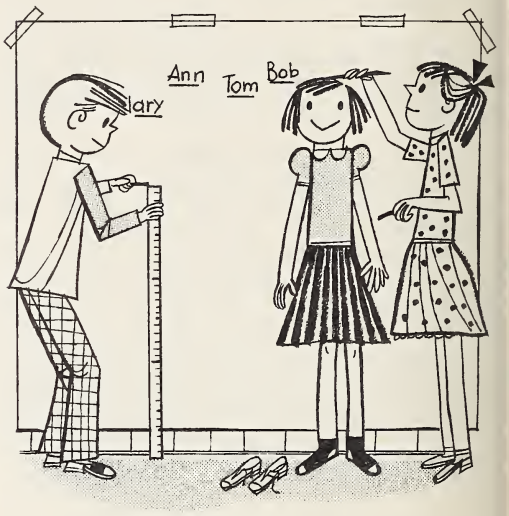
Making a calendar

Some of the children might like to make their own calendar for the year. Let them make a calendar page for each month on drawing paper. Children will have to note the number of days in each month, on what day the month begins, and print numerals accordingly. Those who especially like to draw should be encouraged to make appropriate pictures to illustrate each month. These drawings should appear at the top of the page, above the calendar. Be sure to display the completed calendars.

Activity 25

How tall are we?

To give children experience in making useful measurements, let a committee take the height measurement of each child in the class. Measurements should be made in feet and inches to the nearest inch. There are several ways of making such measurements. For example, a child might stand with his back to a door, on which a sheet of newsprint has been fastened. One of the committee members could mark the child's height on the paper and later use a yardstick to measure off the first three feet and a ruler or rulers placed above it to find the number of inches. Another way to measure children is to have each child lie down on a large sheet of paper placed on the floor. Marks can be made on the paper to indicate the bottom of the child's feet and the top of his head, and the distance between these two marks can be measured after the child gets up.

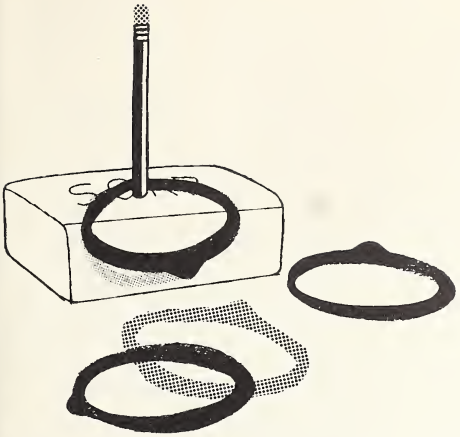


The measurement committee might make a chart showing the height of each member of the class. Then, if the measurements of the same children are taken again near the end of the year, the class will see if their heights have increased.

Activity 26

Ring toss

Additional measuring experiences may be provided by a ring-toss game. Materials for this game may be assembled inexpensively, if no commercial ring-toss game is available. (For example, rubber rings from mason jars may be tossed over a pencil stuck in a bar of soap.) Put the target on the floor and let children try to ring it from a distance of not more than 6 feet. Those who fail to make a "ringer" may measure how far from the target their ring fell, or the distance they tossed the ring, measured from



the tossing point. Able children should make measurements to the nearest inch.

Activity 27

Homemade ruler

Children may make their own rulers for use in various measuring activities. Provide oaktag as material and a few real rulers which the children can use as models. See that each child uses a sharp pencil to draw around the ruler, and tell him to be sure to mark very close to each end of it. When he has cut out this ruler, let him take one of the 1-inch measuring sticks he has used in previous classwork, and place it at the left end of the oaktag ruler. Warn him that this placement must be accurate. Have him draw a line at the end, or right, of this inch, pick up the 1-inch measuring stick, place the left end against this mark, and draw another line at its right edge, continuing in this way until 12 inches have been marked off. (Warn him that, if he is not careful, the last inch will not be a complete one.) Then have the child number the inches he has marked off, starting with the first line drawn. Later on, the children may draw half and quarter-inch marks.

Activity 28

Designs

Children may gain experience in measuring while doing art work. You can have them draw squares, triangles, and rectangles (give examples of each) with sides of varying measurements, such as 1, 2, or 3 inches. Pupils may color their work and display it on the bulletin board.

Another project might involve making 3-inch or 4-inch plaids in color. Try to have samples (pictures from catalogues or actual cloth); then let the children use their imagination in making their own plaids. These drawings, too, should be displayed.

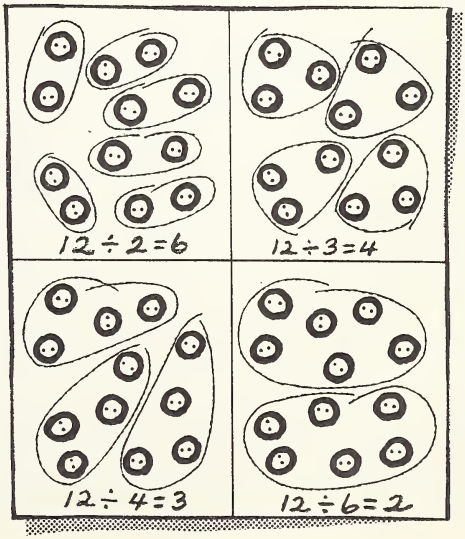
Activity 29

Circling equal groups

The following activity provides practice on division basic facts for the 12 group. You will need to duplicate a supply of the sheet illustrated below. This sheet has been divided into four sections, each of which contains the same arrangement of 12 X's (or 12 of any object you prefer). Slow learners may work with these sheets in their spare time.

Start the activity by asking pupils to circle as many groups of 2 as they can find in the top left section of X's. When they have done this, have them write (in one corner of that section) the basic fact that they have demonstrated. Ask them next to circle threes in the top right section, and to write, as before, the basic fact demonstrated. For the third and fourth sections, you might ask pupils to circle fours and sixes, respectively, or to circle equal groups in two different ways that have not yet been demonstrated.

You might also ask pupils to show four different ways of circling twos on one sheet of the prepared



paper. On another sheet, they could show four ways of circling threes, and so on. The completed sheets might be displayed along the chalk ledge, so that the children can compare the different ways of indicating groups of 12.

A further variation of this activity is to let children work in pairs at the chalkboard—a slow learner paired with an abler student. The able student might draw 12 X's on the board. The other pupil can circle X's in groups as he is directed by his partner and write the basic fact that is demonstrated.

This activity can be adapted to other groups that have more than two basic facts (18, 24, 36). For the 18 and 24 groups you will have to provide four groupings and for the 36 group, three groupings.

Activity 30

The dozen group

An egg carton, with spaces for a dozen eggs, provides a natural setting for working with the basic facts for the 12 group. You will need to collect a number of these cartons. If possible, get cartons that show two arrangements—2 rows of 6 and 3 rows of 4.

To help children with multiplication basic facts for the 12 group, give each child an empty carton and 18 objects (representing eggs). You might begin by having the children arrange these objects into equal groups of two. Explain that you want them to use as many of these groups as necessary to fill the carton, placing one object in each space—in other words, that you want them to find the number of equal groups of two it takes to fill the 12 spaces of the carton.

Have pupils make a tally mark on paper each time a group of two objects is placed in the carton. When all the spaces in the carton are filled, have each child count the tally marks he made, each of which stands for a group of two, and write the number of twos that equal 12 on his paper. Then ask pupils to rewrite this information in equation form.

Let pupils repeat the entire activity, altering the arrangement of objects. Let them work with groups of three, four, five, and six objects. Let them work with groups of five objects (disregarding the extras) to find that there is no equal number of groups of five that make 12.

For practice in division, let the children use colored chalk to mark off, in equal groups, the 12 spaces of the egg carton. Pupils are to show all the ways there are of dividing 12 egg spaces equally (into twos, threes, fours, and sixes), using a different carton to show each way.

Addition and subtraction basic facts for the 12 group may be demonstrated by having students work in pairs, sharing an egg carton. The children can take turns asking their partners to solve such problems as: "I had 5 eggs. Mother gave me 7 more eggs. How many do I have now?" (Be sure the children use only addition and subtraction basic facts for the 12 group in their questions.) The other child should make a group of 5 objects and a group of 7 objects. He would put the group of 5 into the carton first, then the group of 7. (He will, of course, put only one object in a single space.) When the carton is filled, he should say "5 eggs plus 7 eggs equal 12 eggs." For a subtraction problem, the child might say, "I had 12 eggs. I broke 3. How many do I have left?" The other child would have to fill the carton first with 12 eggs. Then he could either remove 3 of them or cover them with paper (to indicate that they are gone). He should then say "12 eggs minus 3 eggs equal 9 eggs."

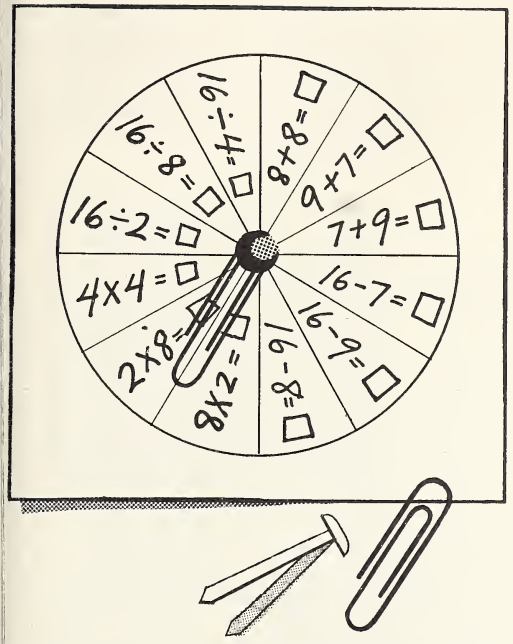
Activity 31

Spin it

The spinning game, described below, is a game in which the whole class may participate. The activity as described provides practice on basic facts for the 16 group, but it can be used for other groups and for mixed facts from any groups.

Materials for making the game are: light cardboard (such as oaktag), a paper clip, and a brass brad. Cut out a 6″ cardboard square and draw a circle on it, being careful to leave enough margin between the rim of the circle and the edge of the card so that a child can hold the card without covering the circle with his fingers. Divide the circle into 12 equal sections or wedges. Make strong pencil or crayon lines to delineate each wedge. Fasten a paper clip to the center of the card by sticking the double flanges of a brass brad through the paper clip and then through the center of the circle. The two ends of the brad are then folded back on the under side of the card. (It is important to fasten the brad loosely, since the clip must be free to spin easily.) Several of the abler students can finish the construction of the game by writing in each of the sections of the circle one of the 12 basic facts: $9+7=$▒, $7+9=$▒, $8+8=$▒, $16-7=$▒, $16-9=$▒, $16-8=$▒, $16\div8=$▒, $16\div4=$▒, $16\div2=$▒, $2\times8=$▒, $8\times2=$▒, $4\times4=$▒.

To play the game, let each child have a spin in turn. Have him read aloud the basic fact that appears in the



wedge where the paper-clip spinner stops. (If the clip stops on a line, as in the picture above, he should spin again.) Let all of the children write this fact (for example $9+7=16$) in equation form with the answer on their papers. Pass the game around the class, in the order in which the children are seated. As each child spins, all the children write the equation in a column on their papers. While the children are spinning and recording equations, have them watch to see whose spin calls for the basic fact with the lowest "answer." The child whose spin calls for the lowest answer wins the game. For example, the lowest answer for the 16 group is 2 ($16\div8=2$), and, of course, several children may spin this same fact, making a tie. If time permits, you could go around the class again. This time have the pupils write the equations in a second column opposite the first column. The pupil who spun the lowest answer the first round now has a "spin off" with the winner of the second round.

Other disks can be made for practice with mixed basic facts. Or disks can be made by pupils to provide practice on specific facts that cause trouble. In this case, pupils may like to have the answers on the back of the disks, so that they can verify the answers while playing the game alone. Once the disks have been made, they can be kept from year to year. Children should be able to play this game on their own.

Activity 32

Addition-subtraction chart

When all the addition and subtraction basic facts have been studied, able students can prepare a two-way chart that shows these facts. Many interesting observations can be made from such a chart.

Provide the children with squared paper (or let them make their own squared paper (10 squares by 10 squares). Have them number the squares in the top row across from 1 to 9, as well as the squares in the first column at the left, as shown in the illustration. (Note that the first square, top left, is to remain empty.) Explain that each figure in the first column at the left will be added to each figure in the top row, and the sum obtained each time will be written in the square where the row and column meet. For example, when the 1 from the first column at the left is added to the 1 in the top row, the sum, 2, is written directly under the 1 in the top row and opposite the side 1. When the 1 at the left is added to the 2 at the top, the sum, 3, is written directly below the top 2 and opposite the side 1, and so on until the second row going across is filled with sums in sequence from 2 to 10. The third row across will show the sums resulting from adding 2 to each of the numbers in the top row, the fourth row across will show the sums resulting from adding 3 to each figure in the top row, etc. Children should be able to complete the chart easily, after having been shown how to fill in one or two rows.

Let the children use the chart to find sums and differences until they understand the chart.

	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

Such a chart, once made, can also be used to check up on subtraction basic facts. To subtract one of the numerals at the left (shaded column) from one of the numbers in its row, the children should look for the answer in the top row, above the number they are subtracting from.

Activity 33

Problem cards

To give children practice in making equations for problems and solving them, prepare 3″ x 5″ cards, lettered A, B, C, etc. (or numbered) for identification. Each card should have one problem written or pasted on it. You may make up these problems yourself, or cut them from old textbooks. Be careful to select those which are easy for the child to read and which state the action clearly. Do not include problems beyond the range of the processes or types of problems taught so far.

Let a pupil pick out five cards at a time. On his paper, opposite the letter or number of each card, he is to write the equation, first with a screen in the place where a missing number is to be inserted, and next with the missing number inserted.

If a problem is concerned with quantities beyond the basic facts, children should solve the problem by computation after setting up the equation, then rewrite the equation, filling in the information they found by computation.

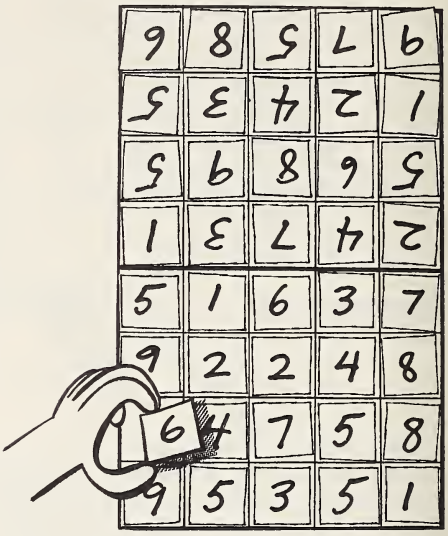
Activity 34

Number checkers

This game may be played by two children. It provides practice in combining numbers to make the addition basic facts for the 10 group. Since the addends are reversible, the numbers may be used in either way for the simplified version of the game, which is intended for slow learners and is described first. It is followed by a more complicated version that is designed for able students.

You will need a "board" 7½″ x 12″. Divide it into squares (5 across and 8 down) and draw a heavy line across the middle, making 20 squares above the line and 20 below. Then make two sets of 1-inch markers, each set in a different color. Each set should be composed of 4 squares bearing the numeral 5 and the remaining 16 squares bearing 2 each of the numerals 1, 2, 3, 4, 6, 7, 8, and 9. The markers should be slightly smaller than the squares on the board.

The twenty numbered squares belonging to each player are to be turned face down and shuffled slightly (as one shuffles dominoes). Each child will set up his own half of the board by drawing squares from his set and placing them face up in rows across the board, starting at the top left directly below the center line and going from left to right.



When the board is set up, explain that the object is to put two numbers together, one on top of another, that will make 10. Explain that the numbered squares may be put on top of any *touching* number, but that numbers may not be jumped. Moves may be made up, down, sideways, or diagonally. Only one move at a time may be made, however. When it is a player's turn to play, he may do one of two things: (1) place a square on top of another touching square if the two numbers equal 10; (2) move a square one space in any direction to an empty space. If slow learners are playing this game, the first child to get all his squares paired up in combinations of 10 is the winner.

Able students should be required to make a second combination of the same two numerals in reverse order; for example, if the first combination of 6 and 4 has been made by placing the 4 on top of the 6, the second combination of these two figures should be made by placing the 6 on top of the 4, even though this may require extra moves to accomplish. Able students may also try to get "kings" across the top row by putting reverse combinations on top of each other. (Since 5+5 has no reverse, one "king" square will

contain two combinations of 5+5.) The first player to fill his top row with "kings" is the winner of this version of the game. Each square in the completed top row, in this case, will contain 4 of the numbered squares.

Activity 35

Number bee

A "Number Bee" will give pupils practice in recognizing the numerousness of a group of pictured objects. The game is especially useful in connection with the number system.

Seat all but one player in a semicircle. This player stands behind the first seated child. He then competes with the seated child in calling out the number illustrated on a card you hold up. (Cards similar to those used in Activity 17, page 321, may be used.) The other players remain silent until it is their turn. If the standing child wins, he moves behind the next seated player and tries to beat him in calling out the next number. If he continues to win, he moves down the line, standing behind each child in turn. If he loses to a seated child, he takes that child's place in the semicircle, and the new winner stands behind the next player. The child who stands up for the greatest number of cards wins the game. Each child should be permitted to keep a mental record of the number of times he stands up.

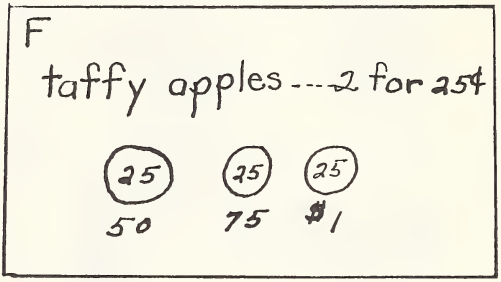
Cards representing two-figure numbers may be mixed with cards representing three-figure numbers. This will lend suspense and a surprise element to the game, since no one will know whether he will get an easy number or a difficult one. Three-figure number cards only may be used when abler pupils are playing the game.

Activity 36

Store solitaire

Playing store by himself with ads pasted on cards can provide a pupil with considerable practice in making change for one dollar.

Materials for this activity may be assembled and prepared by the children. Let them look in local papers for ads that contain lists of familiar articles for sale. Tell pupils to pick out lists of articles priced at less than one dollar. (Items sold in groups for so much—for example, 3 bars of soap for 22¢—are acceptable.) Have the children cut out the lists to fit 4″ x 6″ cards and paste them down, leaving room to identify each card with a letter or a number.



Let each child select a card. Direct him to write the number of the card on his paper. Explain that he can play store all by himself by pretending to be the storekeeper. The card he has chosen shows what he has to sell. He is to imagine that each person who comes to his store will buy one of the items listed and will give him one dollar to pay for it. (Items listed in groups are to be treated as a single purchase.)

Tell the pupil to write the name and price of each article he "sells" on his paper. Below the article he is to make circles to represent the coins he would use in making change for a dollar. He should put the proper figure in each circle to show what coin it represents (1 for penny, 5 for nickel, etc.). Under each coin that he has drawn for his change, have him write the number that he would say in counting out the change to his customer.

Activity 37

Picture store

The following description of playing store with picture cards provides a change-making activity for slow pupils.

Have children divide large cards into six sections and number each section in the lower right-hand corner. They may then either paste a picture of some small article cut from a magazine or newspaper in each section, or make the pictures with rubber stamps. Tell the children to put a price sign (less than one dollar) in each section. (See illustration below.)

When the pupil is ready to play store, tell him to imagine that he has a dollar to spend for any item that is pictured on his card. He should write on his paper the number of the section containing the article he wants to buy, and draw coins to show the change he will receive from his dollar. Direct him to label each coin (represented by a circle) with 1 for penny, 5 for nickel, 10 for dime, etc. He may "buy" each item on the card, each time giving the imaginary clerk an imaginary dollar. If the pupil has difficulty in making change, let him refer to his money chart (described on page 283) and to page 148 of the text.

Keep these cards for other occasions and let pupils exchange cards.

Activity 38

Target toss

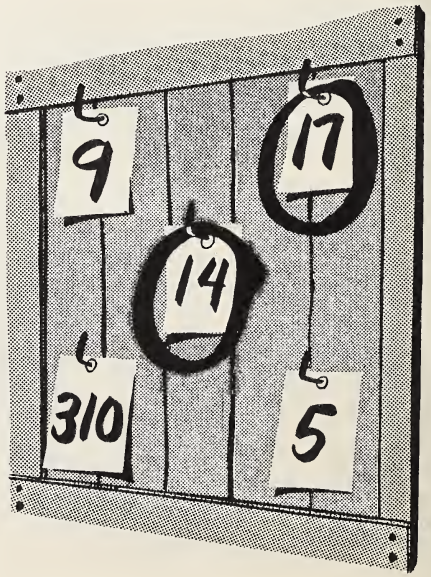
The game of Target Toss can furnish practice on column addition of one-figure numbers, two-figure numbers, and three-figure numbers.

Materials needed are a large square board (or end of an orange crate), 5 drapery angle screws or hooks, 5 or more jar rubbers, and a set of large cards, each with a different number on it (one-figure, two-figure, or three-figure). Punch a hole in the top center of each card. Make the target by screwing the drapery hooks into the wood of the piece of orange crate, one hook in the center and two rows of two hooks each, as shown in the picture below. Then hang a number on each hook.

Decide before the game begins how many "ringers" a player may have at each turn at play. For example, the game can be limited to two ringers at each turn and a maximum of five jar rings to throw. When a player has two ringers, he is through for the turn. He may throw any number of jar rings up to five to get two ringers. The game can be made more difficult by requiring three ringers in 5 throws.

Let each player have a turn at throwing jar rubbers, one at a time, at the hooks from a distance of six feet. The numbers the player rings should be written on the chalkboard by another child under the player's name. Then let each player add up his own total score. The player with the highest score wins. Ties may be broken in a toss-off. Abler pupils can try adding the numbers mentally.

The difficulty of the game may also be controlled by the numbers you choose to hang up and by the number of rings that are thrown.



Activity 39

Box addition

The following activity will help slow pupils to understand the action involved in adding two-figure numbers.

Materials needed are three empty boxes labeled "ones," "tens," and "hundreds," respectively, and about 50 small sticks.

Several children may work together at this activity. Set the three boxes in a row in front of them, the hundreds' box at their left as they face the boxes, followed on the right by the tens' box, and then by the ones' box. Give them a box lid containing the 50 (or more) sticks. Explain that any one of these sticks may stand for 1, 10, or 100, depending on which box it is put into. Then write an incomplete equation on the board containing two two-figure numbers, for example, $85+46=$▒. Tell the children to add these numbers by using sticks.

Have them start with the ones, putting first 5 and then 6 sticks into the ones' box. They should see at once that they have 1 more than 10 in the ones' box. Tell them they can exchange 10 sticks from the ones' box for 1 stick, provided they put this 1 stick into the tens' box. Then have them add the tens, putting first 8 and then 4 sticks into the tens' box. When they have done this, there will be 1 stick in the ones' box and 13 sticks (representing tens) in the tens' box.

Now let them discover that 10 tens may be exchanged for 1 hundred by taking 10 sticks from the tens' box, putting them in the box lid, and picking up 1 stick to put in the hundreds' box. They will then see that they have, in the boxes, 1 hundred, 3 tens, and 1 one. Have someone read this as 131.

Activity 40

Cork drop

"Cork Drop" is a game that will give children practice in adding two-figure and three-figure numbers.

The materials you need are an empty coffee can, or other similar container, and a supply of medium-sized corks. Write or paint a two-figure or a three-figure numeral on the top of each cork. Let each child have up to five tries at getting corks into the can. As soon as he has two in the can, he should look at them and add the numbers. Corks should all be dropped from the same height. (See illustration.)

Able students should use mental calculation in adding the numbers written on the corks dropped in the

can. Slow pupils should be allowed to use pencil and paper in adding their numbers.

The player with the highest total wins.

Provide enough corks so that children cannot become familiar with the number combinations that it is possible to make.

Activity 41

Cafeteria line

When children have had some practice with column addition and the addition of money, they will enjoy playing Cafeteria Line.

You will need a number of 4″ x 6″ cards, each identified by a number. On each card various foods that might be bought for lunch should be listed with the price of each. At the bottom of each card, indicate a price for an imaginary meal. This amount should not exceed one dollar.

Let the child select a card. Explain that he is to see how many different meals he can buy (made up of foods listed) that do not cost more than the amount written at the bottom of the card. Be sure he understands that each meal must be a sensible, well-balanced meal.

Tell him to write the number of the card on his paper, and then write the various menus that he selects, each in a column, with the price of each food item opposite it. Have him find the sum of each column to find the price of each meal.

When subtraction of money has been studied, the activity may be extended by asking children to figure out how much change they should get from the amount of money they present for their meals. Amounts of money to be presented, such as $.50, $.75, $1.00, $5.00, could be included on the cards at this time. Children should be instructed to subtract the cost of the meal they select from the amount of money indicated on the card. Explain that usually change is counted, but for this activity they are to subtract.

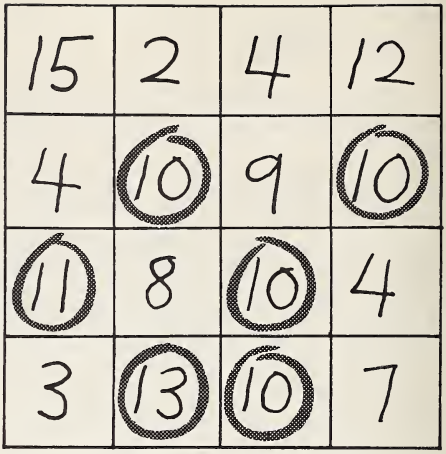
Activity 42

Magic squares

This activity will use addition of one-figure and two-figure numbers and subtraction of two-figure numbers. The objective is to fill in missing numbers in rows so that the sums for each row will be the same both vertically and horizontally.

To prepare for this activity, rule 4″ x 6″ cards into rectangles (four rows of four rectangles each). Arrange numbers, one in each rectangle, in such a way that, when added, the answers for each row will be the same both vertically and horizontally. It will be necessary to fill all the squares in the top row with numbers because that is the only way the child can find out what the sum of each row should be. In the other horizontal rows omit two of the numbers. A sample card is shown in the next column. The circled numbers are the numbers that should be omitted from the card made for the child. He will insert them as a result of his work. For the card shown, the sum of each row is 33.

To get the activity under way, tell the child to rule his paper like the card you give him. (Be sure the circled numbers on the sample card are not included.) Tell him to put in the rectangles on his paper the same numbers as those shown on the card. Then tell the child to add all the numbers in the top row. Be sure he understands that the numbers in each row (down or across) must have the same sum. Suggest to the child that he try next the rows that have only one number missing (the first and fourth vertical rows). Tell him to find the sum of the three numbers. Through discussion and questions help him see that he knows the sum he wants to get and knows three of the numbers used to get this sum. Help him see that he now



has a problem of the how-many-more-are-needed type that can be solved by subtraction. When he has performed these two subtraction problems, he will know all the numbers in the first and fourth vertical rows. He will then have just one number to find in the second and third horizontal rows. And when he has found these, there will be just one number to find in the second and third vertical rows.

Activity 43

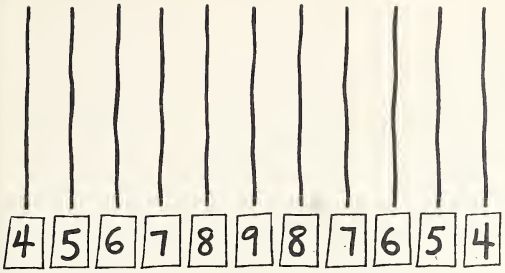
Number football

A "football game," which can be improvised very easily in a small space in the classroom, creates a great deal of interest in practicing multiplication and division basic facts through the 36 group.

You will need 11 pieces of string, each roughly 4′ long, and 11 pieces of typing paper, six of which are numbered from 4 to 9, and five of which are numbered from 4 to 8. These numbers should be large enough to be seen easily. You will also need 3 cardboard ovals or boxes to represent footballs, numbered 2, 3, and 4, respectively.

Place the strings about a foot apart and parallel to one another on the floor. They can be fastened down with cellophane tape at each end. (If you prefer, you can draw lines on the floor.) Place the papers under the strings, or tape them over the chalk lines, in ascending numerical order from 4 to 8 and in descending numerical order from 9 to 4. The football field will look like the picture on the next page.

Divide the class into two teams. (There should be both able pupils and slow learners on each side.) Then



select two children of similar learning ability, one from each team. Give one of them a "football" and tell him to start at one end of the field and progress as far as he can. Explain that at each line he must multiply the number on his football by the number on the line and give the answer. If he gives all the answers correctly, he gets 7 points for a touchdown.

Now the pupil from the opposing team carries the ball. He must progress down the field from the opposite end and give all the answers as he goes. If he gives them correctly, he, too, scores 7 for a touchdown. A turn is now given to another pupil from the first team. His football should be one with a different number from the one used by the first player.

If a player fails to give a correct answer on his way down the field, his team may send in a substitute. The new player will then try to complete the run to the goal line. If he fails, the ball goes to the opposing team. If this team has already scored with this particular ball, they should start a new player out with a ball with a different number.

This game may be played for division basic facts by putting a sequence of dividends all divisible by the same number on the lines. (Some of the lines, in this case, will be without numbers.) As the player proceeds down the field, he uses the number of his football for the divisor, the number on the floor as the number to be divided, and he must give the answer. The game can be adapted to division with remainders by controlling the numbers on the lines.

Activity 44

Multiplication and division chart

A chart for the multiplication and division basic facts through the 36 group, similar to the addition and subtraction basic fact chart Activity 32, pages 327-328, may be prepared by abler students.

Have the children mark off a 4½″ square into half-inch spaces, 9 across and 9 down. Beginning with the second from the left space at the top, have the children number from 2 to 9 in the spaces going *across*. Then have them number from 2 to 9 in the spaces going *down* the left side, starting with the second from the top space. Tell pupils to multiply the 2 at the top by the 2 at the left, and write the answer directly under the top 2 and opposite the side 2. Then tell them to multiply the 3 at the top by the 2 at the left, and write the answer beneath the 3 and opposite the 2. Have them continue multiplying the numbers across the top by 2 and writing in the answers until the second horizontal row is filled. Then have them multiply the numbers in the top row by the 3 at the left side and write the answers in the proper columns. You may need to help them until they seem able to go on by themselves to complete the chart.

When the chart has been made, it can also be used to check up on division basic facts. For this purpose, children use the figures in the first column at the left as divisors, the figures in the rows to the right as the numbers that are to be divided, and the figures in the top row as answers.

	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18			
4								
5								
6								
7								
8								
9								

Your notes

Reference materials

This section of the *Teaching Guide* provides you with charts and tables that will enable you to understand better both the entire program and the materials for this grade.

Bibliography

A list of books and articles that should add interest to and help in the teaching of arithmetic

Chart of problem types

An analysis of the types of verbal problems that the child learns to solve

Time schedule

The authors' estimate of the rate of progress you may expect to make during the year

Grade placement chart

A graphic means of discovering the grade placement of the important topics in arithmetic for Grades 1 to 6 in this program

Word list

A complete alphabetical list of all words used in the pupil's book

Mathematical content

A detailed topical list of the mathematical content of the book

Index

Entries are for the teaching aspects of arithmetic

Reference materials

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Problem types

additive and subtractive situations

type no.	problem description	sample problem	equation	compu-tation	situation-process description	grade
AS-1	Finding the resulting total when the original number and the number added are known	John had 9 apples. Tom gave him 3 apples. How many apples did John have then?	$9 + 3 = n$	$9 + 3$	additive-addition	3
AS-2	Finding how many were added or how many more are needed when the original number and the resulting total or desired total are known	John had 9 apples. After Tom had given him some more apples, he had 12 apples. How many apples did Tom give him?	$9 + n = 12$	$12 - 9$	additive-subtraction	3
AS-3	Finding how many there were to begin with when the number added and the resulting total are known	John had some apples. Tom gave him 3 apples. Then he had 12 apples. How many apples did John have to begin with?	$n + 3 = 12$	$12 - 3$	additive-subtraction	3
AS-4	Finding the number left when the original number and the number gone are known	John had 12 apples. He lost 3 of them. How many apples did he have then?	$12 - 3 = n$	$12 - 3$	subtractive-subtraction	3
AS-5	Finding the number gone when the original number and the number left are known	John had 12 apples. Then he lost some. He had 9 apples left. How many apples did he lose?	$12 - n = 9$	$12 - 9$	subtractive-subtraction	4
AS-6	Finding the original number when the number gone and the number left are known	John had some apples. He lost 3 of them. Then he had 9 apples left. How many apples did he have to begin with?	$n - 3 = 9$	$9 + 3$	subtractive-addition	4
	rate situations					
R-1	Finding the total number when the number in each group and the number of equal groups are known	John had 4 boxes of 3 apples each. How many apples did he have?	$4 \times 3 = n$ $\frac{3}{1} = \frac{n}{4}$	4×3	multiplicative-multiplication rate-multiplication	3 5
R-2	Finding the number in each of the equal groups when the resulting total number and the number of groups are known	John put 4 equal groups of apples into a box. Then he saw that he had 12 apples in the box. How many apples were in each group that he put into the box?	$4 \times n = 12$ $\frac{n}{1} = \frac{12}{4}$	$12 \div 4$	multiplicative-division rate-division	5 5
R-3	Finding the number of equal groups when the resulting total number and the number in each of the equal groups are known	John put several groups of 3 apples each into a box. Then he saw that he had 12 apples in the box. How many groups of apples did he put into the box?	$n \times 3 = 12$ $\frac{3}{1} = \frac{12}{n}$	$12 \div 3$	multiplicative-division rate-division	5 5
R-4	Finding the number of equal groups when the original total and the number in each of the equal groups are known	John had 12 apples. He put a group of 3 apples into each of several boxes. How many boxes did he use?	$12 \div (3) = n$ $\frac{3}{1} = \frac{12}{n}$	$12 \div 3$	quotitive-division rate-division	3 5
R-5	Finding the number in each of the equal groups when the original total and the number of equal groups are known	John had 12 apples. He put equal groups of these apples into each of 4 boxes. How many apples did he put into each box?	$12 \div n = (4)$ $\frac{n}{1} = \frac{12}{4}$	$12 \div 4$	partitive-division rate-division	3 5
R-6	Finding the original number when the number in each of the equal groups and the number of equal groups are known	John had some apples to put into 4 boxes. He put 3 apples into each box. How many apples did he have to put into the boxes?	$n \div 3 = 4$ $\frac{3}{1} = \frac{n}{4}$	4×3	divisive-multiplication rate-multiplication	5 5

comparison situations

type no.	problem description	sample problem	equation	computation	situation-process description	grade
C-1	Finding how {many more / much more} or how {many fewer / much less} one quantity is than another	John has 12 apples and 9 oranges. How many {more apples / fewer oranges} than {oranges / apples} has he?	$12 - 9 = n$	$12 - 9$	comparison-subtraction	3
C-2	Finding the smaller quantity when the larger quantity and the excess of the larger quantity or the deficiency of the smaller quantity are known	John has 12 apples. He has 3 {more apples than oranges. / fewer oranges than apples.} How many oranges has he?	$12 - n = 3$	$12 - 3$	comparison-subtraction	6
C-3	Finding the larger quantity when the smaller quantity and the deficiency of the smaller quantity or the excess of the larger quantity are known	John has 9 apples. He has 3 {more oranges than apples. / fewer apples than oranges.} How many oranges has he?	$n - 9 = 3$	$9 + 3$	comparison-addition	6
C-4	Finding the ratio of one quantity to another (situations involving "times as many as," "fraction as many as")	John has 12 apples and 4 oranges. He has how many times as many apples as oranges? He has what fraction os many oranges as apples?	$\frac{n}{1} = \frac{12}{4}$ $\left(\frac{1}{n} = \frac{12}{4}\right)$	$12 \div 4$ $(4 \div 12)$	comparison-division	5 6
C-5	Finding a quantity when the other quantity and the ratio ("number times as many as" or "fraction as many as") of the first quantity to it are known	John has 12 apples. He has {3 times as many / ⅓ as many} apples as oranges. How many oranges has he?	$\frac{3}{1} = \frac{12}{n}$ $\left(\frac{⅓}{1} = \frac{12}{n}\right)$	$12 \div 3$ $(12 \div ⅓)$	comparison-division	5 6
C-6	Finding a quantity when the other quantity and its ratio ("number times as many as" or "fraction as many as") to the first quantity are known	John has 12 oranges. He has {3 times as many / ⅓ as many} apples as oranges. How many apples has he?	$\frac{3}{1} = \frac{n}{12}$ $\left(\frac{⅓}{1} = \frac{n}{12}\right)$	3×12 $(⅓ \times 12)$	comparison-multiplication	5 6

Time schedule

The authors do not believe it possible to provide a rigid schedule for teachers to follow in using *Seeing Through Arithmetic 3*. Differences in the backgrounds and abilities of children make a uniform schedule impractical. Nevertheless, many teachers and schools feel a need for some kind of schedule that will serve as a general guide in covering the year's work. The schedule at the right, given in six-week periods, is based upon the authors' judgment and experience with the materials and upon the experience of teachers now using *Book 3*. No attempt should be made to force a class to maintain the pace indicated or to retard a class to that pace.

period	pages of book 3	content
1	3-60	all basic facts through 10 group
2	61-103	problem solving; basic facts through 12 group
3	104-138	basic facts through 18 group
4	139-173	addition of 2- and 3-figure numbers
5	174-208	subtraction of 2- and 3-figure numbers; basic facts through 25 group
6	209-251	basic facts through 36 group; fractions; review

topic	grade 1	grade 2	grade 3
groups and number systems	recognizing, combining, separating, and rearranging through 10	recognizing, combining, separating, and rearranging through 18	recognition through 36
decimal system of enumeration	through 99; place value	through 999; place value	through 9999; place value; preparation for carrying and borrowing
basic facts		through sums and minuends of 10; informally through products and dividends of 10	through sums and minuends of through products and dividends of 36
money	coins through dime; related values; counting	coins through quarter; related values; counting	equivalents of $1; writing; making change; addition and subtraction
measures	idea of standard unit; development of judgment and physical competence	idea of standard unit; concept of inch, foot, pint, quart; development of judgment	equivalents; dozen; calendar; time; weight; reduction
processing addition and subtraction of whole numbers			3-figure numbers; carrying and borrowing
processing multiplication of whole numbers			
processing division of whole numbers			
meaning of fractions		judgment in selecting halves and fourths	unit and non-unit through eight reading and writing
processing addition and subtraction of fractions			
processing multiplication of fractions			
processing division of fractions			
ratio (see per cent)			preparation for reduction
graphs and scale drawing			
geometry			identification of circle, square, triangle
decimal fraction numerals			
per cent			
problem solving (see chart on pages 340-341)		pictorial representations; development of visualizations; introduction of action ideas	types AS-1, AS-2, AS-3, AS-4, R-1, R-4, R-5, C-1
meaning of the processes		associating combining and separating actions with problems	order of addends and factors; inverse nature of processes
topic	grade 1	grade 2	grade 3

Grade placement of topics

Seeing through arithmetic

Scott, Foresman

grade 4	grade 5	grade 6	topic
		number line for system of integers and for system of fractions	groups and number systems
through 999,999,999; place value	reading and understanding decimal numerals through hundredths	development of decimal notation as a system	decimal system of enumeration
through products and dividends of 81	used in processes	extension to decimal fraction numerals (as a system)	basic facts
multiplication and division			money
scale; weight; liquid (fl. oz.); dry; mile; abbreviations	square measures; acre;	cubic measures; meter; gram; liter; kilogram; kiloliter	measures
retaught; extended to larger numbers	extended to larger numbers	maintained; associative law for addition	processing addition and subtraction of whole numbers
1-figure and 2-figure multiplier; carrying	extended to larger numbers	maintained; associative law; distributive law	processing multiplication of whole numbers
1-figure and 2-figure divisors ure divisors optional); remainders	2-figure divisors; remainders	maintained; distributive law	processing division of whole numbers
equivalent; improper fraction umerals and mixed numerals; use in measurement	reduction; comparing	maintained	meaning of fractions
	proper fraction numerals and mixed numerals	maintained	processing addition and subtraction of fractions
		proper fraction numerals and mixed numerals	processing multiplication of fractions
		proper fraction numerals and mixed numerals	processing division of fractions
	using ratios to express rate and comparison; reduction	more complex applications of rate and comparison; use of the ratio test	ratio (see per cent)
meaning of linear scale on map	reading scales and scale drawing; interpreting bar graphs and pictographs	making graphs of sets of ordered pairs	graphs and scale drawing
parallel lines; right angle; rectangle	concept of area; perimeters; area of rectangle	area of general parallelogram; identification of solids; concept of volume; volume of rectangular prism	geometry
	reading and understanding through hundredths	addition; subtraction; multiplication; division	decimal fraction numerals
	introduction (as ratio)	complete development	per cent
pes AS-5, AS-6, C-4 (limited to ng "how many times as many as")	types R-1, R-4, R-5 (extended to ratios); R-2, R-3, R-6 (complete); C-4, C-5, C-6 (fractions excluded)	types C-4, C-5, C-6 (extended to fractions); C-2, C-3 (complete)	problem solving (see chart on pages 340-341)
	extended to include common fraction numerals	extended to include decimal fraction numerals	meaning of the processes
grade 4	grade 5	grade 6	topic

Word list

This list contains the 436 different words that appear in *Seeing Through Arithmetic 3*. Of these 436 words, 147 were used in the preceding book, *Numbers in Action*. These 147 words are in italics. Children who have completed The New Basic Reading Program of the Curriculum Foundation Series, through the new *More Friends and Neighbors* (2^2), will be familiar with 176 of the 289 words not used in *Numbers in Action*. These 176 words are indicated by asterisks (*). For these children, only 113 words will be new in this book. Of these 113 words, 63 are used in the new *Streets and Roads* and the new *More Streets and Roads*. Children using The New Basic Reading Program will have to cope with only 50 additional words.

The numeral at the right of each word indicates the page of first occurrence. For a list of words introduced on the pages of the pupil's book, see the Lesson Briefs in this *Teaching Guide*, pages 15 to 201.

The following forms of known words are not counted as new and therefore are not listed: inflected forms made by adding *s*, *es*, *d*, *ed*, *ing*, *er*, or *est* of comparison (including those forms made by changing *y* to *i*, dropping the final *e*, or doubling the final consonant in the root word); derivatives formed by adding *er* of agent or the suffixes *-en*, *-ly*, *-y*, *-th*, *-ty*, and *-teen*; possessives; compounds of known words; and contractions in which the apostrophe represents only one omitted letter.

*a, 8
able, 78
*about, 3
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add, 5
*after, 102
*afternoon, 169
airplanes, 26
all, 41
also, 14
altogether, 80
amounts, 148
and, 3
*animals, 113
*Ann, 67
*another, 70
*answer, 93
*any, 162
apiece, 127
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are, 4
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*ate, 50
away, 8
bags, 30
ball, 5
*balloon, 77
*banks, 27
*barnyard, 37
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baseball, 179
basket, 41
be, 4
bears, 77
*because, 92
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*been, 238
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*before, 109
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*bells, 27
belong, 62
*Betty, 9
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Billy, 24
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*birthday, 14
*black, 114
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*Bob, 82
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*both, 233
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*bought, 29
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*breakfast, 106
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*butterflies, 101
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*by, 18
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*came, 41
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*caps, 78
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*cats, 130
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*chairs, 127
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*change, 56
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*circus, 108
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*count, 55
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*earned, 115
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*hammers, 21
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Mathematical content

Numerals and the number system

- Recognition of groups larger than 10
- Reading and writing numerals to 9999
- Place value through thousands
- Regrouping as required in carrying and borrowing
- Ordinals (as a system)

Addition of whole numbers

- Concept of addition
- Basic facts for all groups
- Changing order of addends
- Addition of three or more one-figure numbers
- Addition of two-figure numbers
- Addition of three-figure numbers
- Addition involving the cents' point

Subtraction of whole numbers

- Concept of subtraction
- Basic facts for all groups
- Relation between addition and subtraction
- Subtraction of two-figure numbers
- Subtraction of three-figure numbers
- Subtraction involving the cents' point

Multiplication of whole numbers

- Concept of multiplication
- Basic facts through products of 36
- Changing order of factors

Division of whole numbers

- Concept of division
- Basic facts through dividends of 36
- Relation between multiplication and division

Measurement

- Concept of standard unit
- Recognition of right and wrong procedures
- Measures of capacity—pint, quart, gallon
- Measures of length—inch, foot, yard
- Measures of quantity—dozen
- Measures of time—second, minute, hour, day, week, month, year
- Measures of weight—ounce, pound
- Reduction of measures (within scope of processes taught)

Money

- Recognition of all coins and paper money
- Value relations among the coins
- Counting money—dollars and cents
- Reading and writing numerals that represent dollars and cents
- Making change
- Addition involving the cents' point
- Subtraction involving the cents' point

Fractions

- Concept of fractions
- Unit and non-unit fractions with denominators of 2, 3, 4, 5, 6, 7, and 8
- Readiness for reduction of fractions

Problem solving

- Making equations for eight types of problems
- Finding the new total group when the sizes of the smaller groups are known
- Finding the remaining group when the size of the removed group is known
- Finding the new total group when the size and number of the equal smaller groups are known
- Finding the number of equal groups when the size of the equal groups is known (quotition)
- Finding the size of the equal groups when the number of equal groups is known (partition)
- Finding how many were added or how many more are needed when the number to begin with and the resulting total number are known
- Finding how many there were to begin with when the number added and the resulting total are known
- Comparing two groups by finding how many more or how many fewer one group is than the other

Index

The purpose of this index is to help you locate material in this Teaching Guide that pertains to the *teaching* of various arithmetical concepts. For location of subject matter in the pupil's text, see the index to the text.

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Your notes

Your notes

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